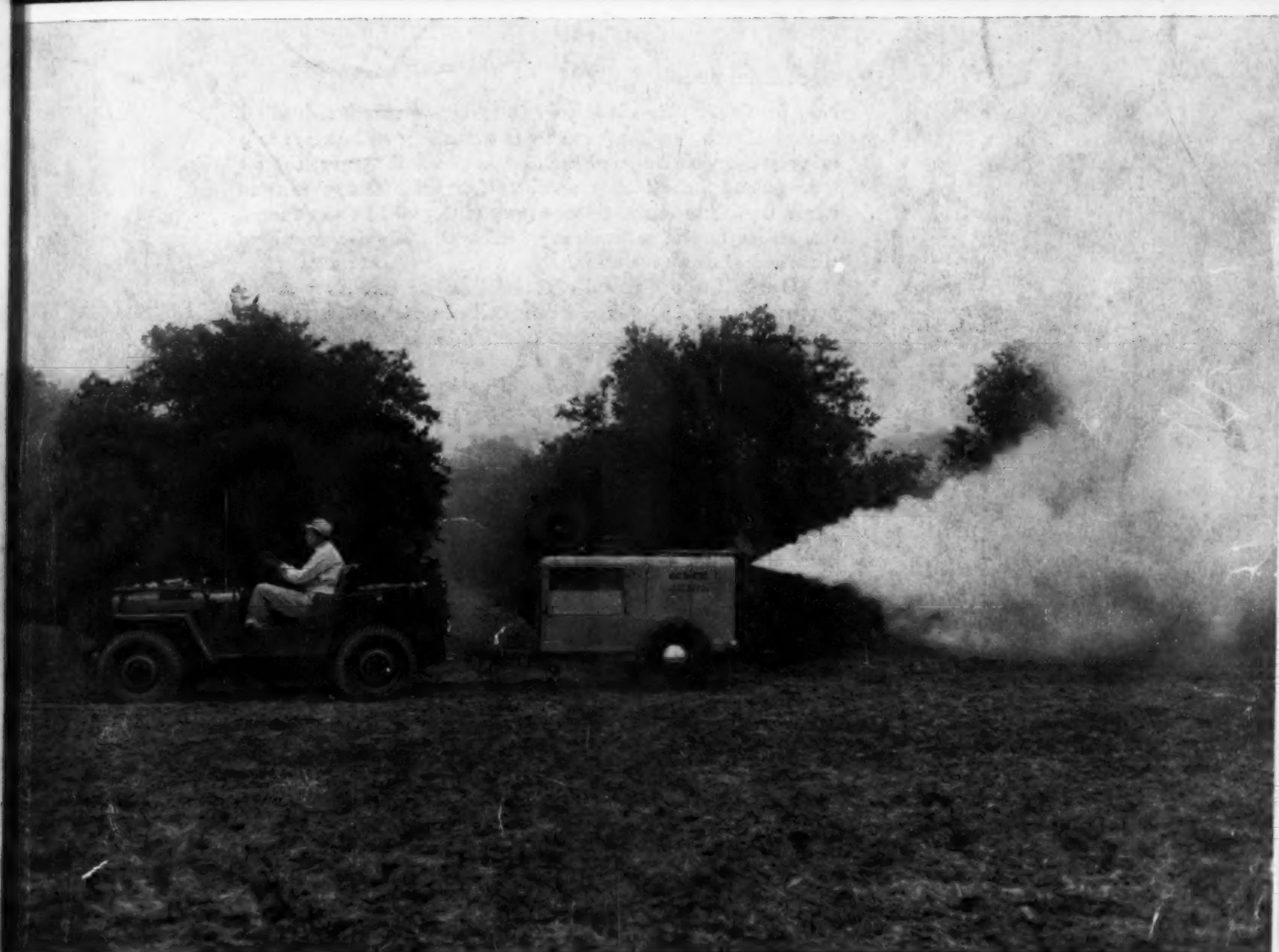
AGRICULTURAL CHEMICALS



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Volume II March, 1947 Number 3

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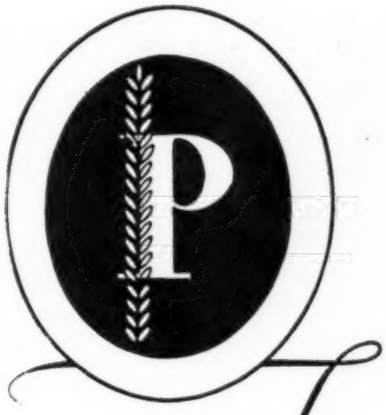

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Figure 1

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Figure 2

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MARCH, 1947
Vol. II No. 3

A Monthly Magazine For the Trade

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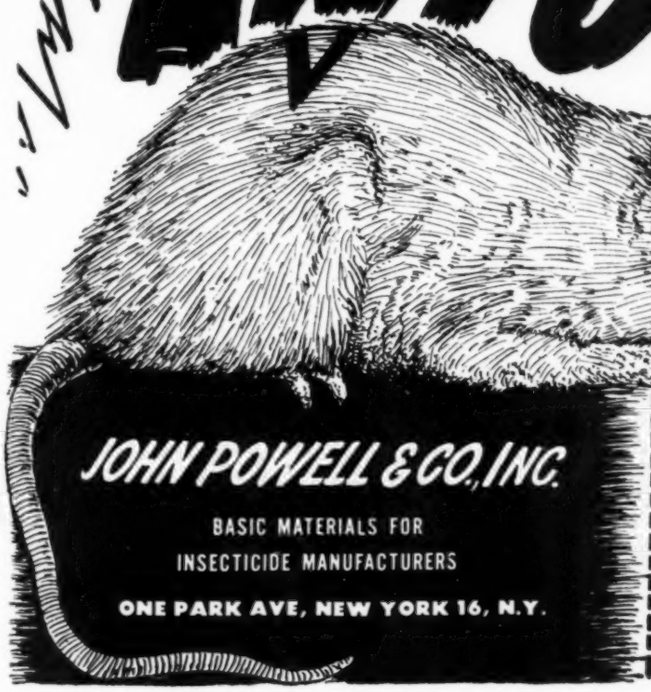

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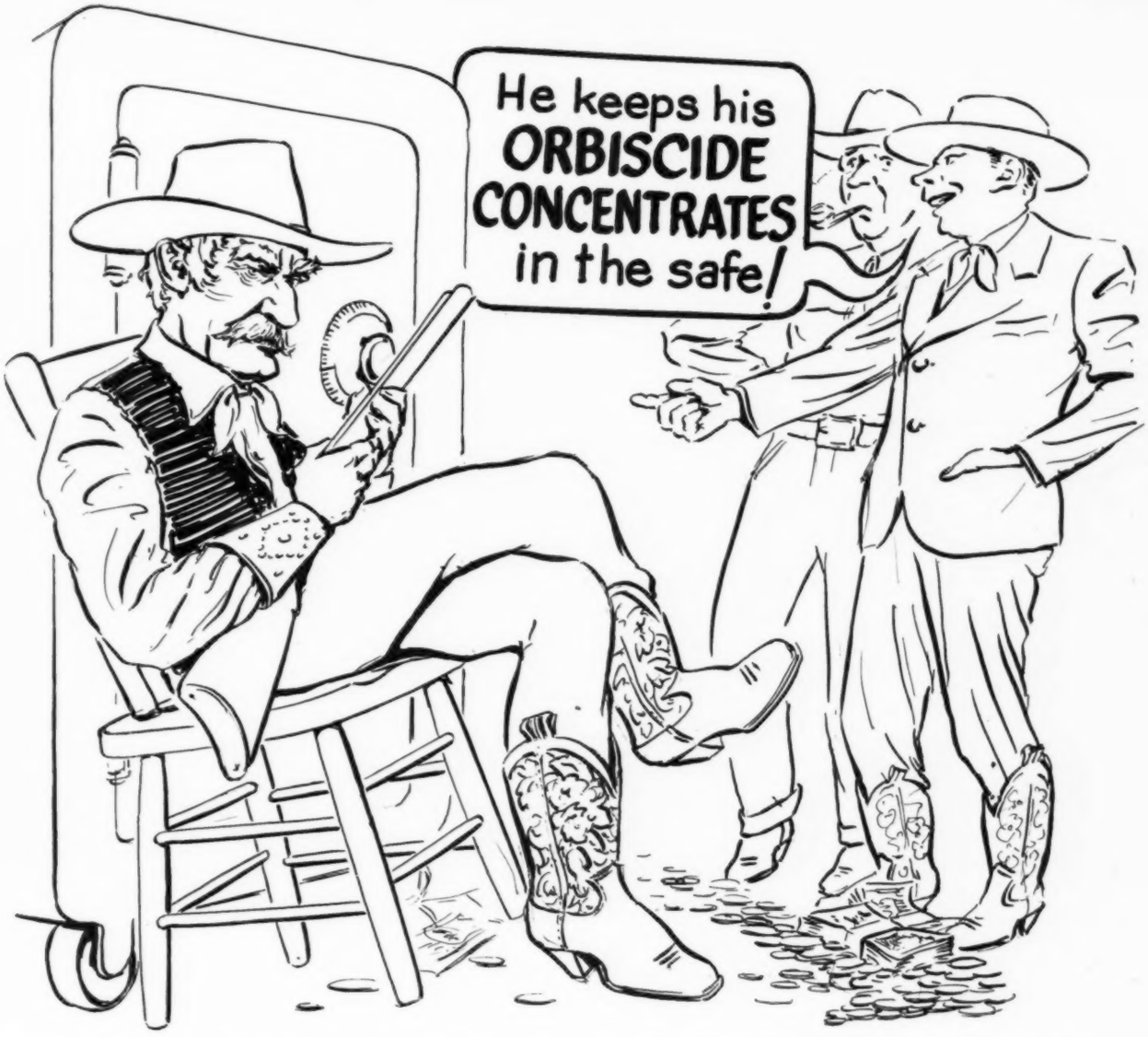

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THE EDITOR COMMENTS

LESS than one-eighth of the total agricultural acreage of the United States receives any sort of chemical treatment against fungi, weeds, insects or other pests, according to the *AIF News*. This startling fact drives home the realization that seven-eights of the potential market as yet remains unsold. In one way, it shows that selling may have been either comparatively unsuccessful or highly restricted. On the other hand, it indicates the potentialities of the market which expanded selling might develop.

Obviously, the market for an expanded consumption of most agricultural chemicals is there. But how and when to get at it? Only by knowing a lot more about the market than we now know,—and the answer to that has already been given by the Agricultural Insecticide & Fungicide Association in a recent recommendation that a broad survey of the whole field should be undertaken at once. Inasmuch as every manufacturer, mixer, dealer, distributor, co-op, and others in agricultural chemical channels, as well as American agriculture, have a real interest at stake, this recommendation should be pursued vigorously to the end that steps toward this survey be taken,—and soon!

LITTLE does the average business man appreciate the extent to which trade associations have held an umbrella over his interests in recent years, protecting him against all sorts of screwball legislation, regulation, and against misguided zealots who for years have viewed business as only interested in mulcting the public. Particularly, the non-member of any trade association is usually unaware of the headaches which he may have avoided as a result of industry group activities. Today, with the horizon literally dark with thousands of proposed state laws and regulations, the importance of intelligent association action is greater than ever.

For years, leading students of law-making have held that the real answer to business abuses and chicanery is not legislation, but education. They have held also that a large majority of laws which restrict and regulate business and industry could be eliminated, and could have been made unnecessary, by long range educational programs. Accordingly, as we see it,—and while still holding the protective umbrella overhead,—organized trade groups might look more closely at education. Otherwise, this legislative snowball may roll on and on forever, overwhelming all business eventually by its very size. If organized education is the answer to prevent more and ever more laws, lets look into it!

WHETHER government should at any time engage in business in competition with private industry has long been a hotly debated question. Bills introduced into the Oklahoma Legislature providing for state purchase and application of certain spray materials are the latest case in point. Last year, some rather large scale buying and use of DDT for mosquito control as a public health project by other states aroused considerable criticism. The feeling is quite common among those who earn their living producing, distributing, or applying insecticides, fungicides, and weed killers that this sets a dangerous precedent representing a potential threat to their future. Short steps beyond would include a permanent department in each state to purchase its own equipment,—and then establishment of a plant to make its own spray products.

For the protection of all private enterprise, we feel that this tendency for states to expand their operations under guise of public necessity should be opposed. Industry should supply this service,—under experiment station supervision if deemed necessary. Even on a temporary basis, we do not feel that any state should be in the insecticide or the spraying business any more than the federal government should be in the fertilizer business. In this respect, it is apparent that the insecticide and fungicide industry, and the custom sprayer must make their voices heard by legislators and public officials in general.

Guest Editorial written especially for this issue of Agricultural Chemicals.

Use of Chemicals in Agriculture Keeps Step With Advances in Other Scientific Fields

By J. H. Mohler

Secretary of Agriculture, State of Kansas

THE field of agricultural chemicals is keeping in full step with other scientific advancements of the time. The span of a relatively few years, has seen almost unbelievable developments — from the fly swatter to DDT; from the hoe to 2,4-D and other weed killers; from the steel trap to chemical rat killers; and from barnyard manure fertilizer to commercial products used throughout the nation in amounts totaling thousands upon thousands of tons annually. Revolutionary changes such as these appear on every hand. Their contributions to agriculture and civilization are so vast and far-reaching as to be wellnigh incalculable, affecting as they do the lives of all.

Reflection on these things indicates that the test-tube and microscope are among the most powerful of all modern tools and weapons. Guided by the skilled fingers and trained eyes of scientists they have become tremendous economic and humanitarian forces.

Although chemicals are of inestimable value to mankind, it is our purpose here to refer briefly to them in relation to agriculture, particularly in the light of some rather recent developments. Consider, for instance, the possibilities of DDT, which has held the attention of the public for the past two years. Within this period, demonstrations in various parts of the nation have proved its efficacy. For instance, applications of DDT on livestock in Kansas have indicated that beef animals properly treated may gain from 30 to 70 pounds per season more than cattle subject to flies and other insects. It has been estimated that horn flies in the state of Kansas caused beef losses of some 10 million dollars in 1945 and much more than that in 1946.

Other tests show equally remarkable results in milk production by dairy cattle protected by DDT. By treating every beef and dairy animal in the country, it is estimated that individual benefits would multiply about 80 million times, and that the nation's additional income from increased amounts of beef, milk and manufactured dairy products would reach significant proportions.

This would mean more meat, more milk, more cheese and more of many other natural foods for Americans. Back of food for people, however, is the problem of feed for animals.

(*Turn to page 65*)

Oil Sprays

P. J. Chapman and G. W. Pearce

New York State Agricultural Experiment Station, Geneva, N.Y.

PART I

PETROLEUM oils find a variety of important applications in the insecticide field. They may be used (a) as the sole or primary insecticidal agent as in the case of horticultural oil sprays and with products employed in the treatment of mosquito breeding sites; or (b) serve as solvents and carriers for such toxicants as the pyrethrins, thiocyanates, rotenone and DDT, and typified by the "fly sprays;" or (c) be utilized as adhesives or conditioners in spray, dust and poison bait formulations.

This article, however, is concerned only with oils as they are employed in the first use-class—more specifically, with the water borne oil sprays applied to fruit trees.

Petroleum oils are used to combat pests of the citrus and hardy tree fruits almost everywhere in the world where these trees are grown. Most commonly used to control various species of scale insects, oils are also widely employed to combat mites, psyllids, mealy bugs, plant bugs (apple red bug, for example), tortricids, especially the fruit tree leaf roller, and others.

The consumption of oil for the foregoing purposes is estimated at 10,000,000 gallons annually in California, Oregon and Washington while east of the Rocky Mountains about 5,000,000 gallons are used. World usage may be around 25,000,000 gallons annually. If we assume this oil is used at the average rate of 2½% in spray mixtures, then the world uses a billion gallons of oil spray annually.

Tree spray oils are usually divided into two classes: those intended for use primarily on the hardy tree fruits during the dormant period and called *dormant oils*, and those applied to trees in foliage or the *summer oils*. The oils used on citrus in California may be classed as summer oils. The two groups differ chiefly in the degree of refinement of the oil used and in its heaviness or viscosity. Generally speaking, summer oils are more highly refined and of lighter viscosity than dormant oils. This classification is rather arbitrary. With the trend toward using the so-called dormant oils after growth starts, it is expected that the distinction made between the two classes will have less and less meaning.

Just what the future holds for the spray oils cannot be foreseen. For the immediate future, no diminution in use is expected. It may well be increased. In New York, for example, fruit growers are expected to use more oil during the dormant and semi-dormant period in 1947 than ever before in history. This situation has been created by an unprecedented upswing in European red mite activity this past season. The pest is reported to have been equally active in all of the Northeastern States in 1946.

Petroleum oil sprays have a long and highly useful record of achievement. A liquid insecticide possessing the qualities of petroleum oil has many advantages. Good as our present day oil sprays are, however, there is room for considerable improvement. The possibility of causing direct or indirect harm to the tree or plant, particularly with citrus fruits, constitutes the most serious limitation of present day spray oils. Unless this hazard can be eliminated or greatly minimized, other insecticides may eventually gain preference over petroleum oil in certain exacting areas of use.

Base Oil

CRUDE petroleum varies greatly in composition. Differences exist not only between crudes from the major production fields but often between wells within a given field. Three general classes of crudes originate in this country, *viz.*: paraffinic base, asphaltic base (or sometimes

called naphthenic base) and mixed base crudes (the mid-continent crudes).

Spray oils are made from all crude classes. On the west coast asphaltic base crudes are utilized owing chiefly to the fact that California crudes are largely of this general class. East of the Rockies, spray oils may be derived from any of the crudes but principally from asphaltic and mixed base stocks. The highly paraffinic crudes from the Pennsylvania field are little used for tree spray oils because of their value as a source of lubricants. It should be recognized, however, that under modern refining methods, oils of high paraffinicity may be manufactured from crudes originating outside the Pennsylvania field.

Spray oils are derived from the lighter portion of the lubricant fraction of petroleum. In addition to being used as spray oils, these or closely related products have various industrial applications.

Fruit tree leaf roller egg masses on apple twig. (slightly enlarged) This species was used extensively in the biological evaluation of dormant oils.

Three major classes of carbon structures are involved in the constitution of the hydrocarbons present in such oils. These are aromatic rings, paraffin chains and naphthene rings. These occur in complex combinations which are extremely difficult to isolate and identify individually. However, it is now possible thru analysis to arrive at an approximation of the overall percentage of each structure present.

The essential structural differences between a so-called naphthenic and a paraffinic oil are given in Table I. The oils shown are assumed to have the same molecular weight, and refinement has been carried to the point where the aromatic content of each is the same. The figures for the paraffin chains and naphthene rings approach the extremes encountered among oils suitable for use in spraying. Consequently, it would be possible to have all gradations in between depending on the nature of the crude utilized and the process of manufacture.

Refinement operations in the case of oils in the spray oil range have as their principal object the lowering or elimination of the aromatic and unsaturated structures present. This usually consists of treatment with strong sulfuric acid or SO_2, The reacting portion forms *sulfonates,* representing roughly the aromatic content of the oil, especially if the reaction is carried to the point of exhaustion. The unaffected part is the *unsulfonated residue,* or U. R., a term which is widely used in spray oil specifications and literature to indicate degree of refinement.

It was early learned that the safeness of oils to plants *in foliage* is related to the aromatic content of an oil. Thus, within limits, the higher the U. R. value the safer the oil would be to use on evergreen plants or deciduous plants during their growth period. This finding formed the basis for the well known Volck (16) spray oil patents. Oils receiving sufficient refinement to have a U. R. value of 85% or higher came within this claim. These patents have now expired.

This question naturally arises: What kind of oil is to be preferred for spray oils? Studies conducted over the past six years in New York (3,10) show that control efficiency is related to the paraffinicity of the oil. The more paraffinic the oil, the greater its efficiency.

Contrary to common belief, the aromatic and unsaturated constituents apparently contribute little to the insecticidal efficiency of a conventional tree spray oil, at least for the species given below. Thus, while it might be desirable to lower the aromatic content for plant safety reasons or to raise the paraffinic content of the oil, there seems to be little basis for the belief that some insect killing power is being sacrificed thereby.

The relationship of paraffinicity to insecticidal efficiency was shown or indicated for such pests as the fruit tree leaf roller, *Archips argyrospila* (Walk.), apple red bug, *Lygidea mendax* Reut., San Jose scale, *Aspidiotus perniciosus* Comst., scurfy scale *Chionaspis furfura* (Fitch), European red mite *Paratetranychus pilosus* (C. and F.) and against the eggs of the codling moth

TABLE I
Chemical Structure of Spray Oil Types

	Percentage of Each Structure		
	Paraffin Chains	Naphthene Rings	Aromatic Rings
Highly paraffinic	75	15	10
Highly naphthenic	50	40	10

Carpocapsa pomonella (L.), oriental fruit moth, *Grapholitha molesta* (Busck), eye-spotted bud moth, *Spilonota ocellana* (D and S) and the grape berry moth, *Polychrosis viteana* (Clem.). Reports from workers in other areas on studies now in progress suggest that this principle may hold true for many other species including pests of citrus.

Should our spray oil, then, be of a paraffinic type? Paraffinic type oils are advised in New York and have been for the past 5 years. Specifications were established — about which more is said later—and most of the spray oil now used in the state meets this standard.

Widespread Use?

WHETHER it would be desirable for spray oil suppliers everywhere now to adopt a paraffinic product is to be seriously questioned. In some areas there would be little if any local experience in the use of paraffinic spray oils to serve as a basis for such a sudden change. Furthermore, economics as well as entomology would affect such a decision. It is not that the naphthenic oils are ineffective; they have been successfully employed for many years as the vast oil spray usage on the West Coast fully proves. The so-called naphthenic oils are not devoid of paraffinic structures as seen in Table I. *They are in a sense simply low paraffin oils.*

Under New York conditions where the differences in cost of the several classes of oils are not great, a paraffinic type oil is preferred, chiefly for the greater per gallon efficiency obtained. Presumably this same reasoning would apply in other areas east of the Rockies.

If paraffinic oils were to be used on the west coast they would have to be shipped in. Considering the price differential that would exist favoring local oils and the fact that spray oil usage has been based on naphthenic products from the start, one can readily understand why west coast spray oil suppliers favor naphthenic oils over the paraffinic types for that area.

The primary point is that insecticidal efficiency is related to the basic composition of the oil. The full applications of this principle remain to be worked out. For a number of the pests controllable with oil sprays, efficiency was found to be correlated with the degree of paraffinicity of the oil. It is possible with other insects (aphids in the egg stage for example) that efficiency may be related to some other constituent, such as the aromatics. Just how the composition principle can be made use of in a practical manner at the present time is perhaps less important than the recognition that it governs efficiency of control. Very much more research remains to be done. Meanwhile, our thinking should not be too much influenced by past practices or the economics of the situation at a given time. What appears impossible or impractical today, science has a way of making possible tomorrow.

Oil heaviness can be expressed in terms of its viscosity at a given temperature. Viscosity is commonly used in characterizing the heaviness of oils used as lubricants. It has also been utilized in spray oil specifications. Altho the use of viscosity in such specifications is useful and convenient it has given rise to some false impressions regarding its role in

TABLE II
Dormant Oil Specifications in New York for 1947*

	Regular Type	Superior Type
Viscosity (Saybolt, at 100°F.)	90-120 Sec.	90-120 Sec.
Viscosity index (Kinematic)	65 (min.)	100 (min.)
Gravity (A. P. I. degrees)	28 (min.)	32 (min.)
Unsulfonated residue (A.S.T.M.)	78-85%	90-92%
Pour point	Not greater than 30°F.	
Homogeneity	A relatively narrow boiling distillate portion of petroleum	

* The following methods of testing spray oils are to be used: *Viscosity*: Kinematic, A.S.T.M. Designation: D 445-39T. *Conversion to Saybolt Universal Viscosity*, A.S.T.M. Designation: D 446-29. *Kinematic Viscosity Index*: A.S.T.M. Designation: D 567-40T. A. P. I. *Gravity*: A.S.T.M. Designation: D 287-39. *Pour Point*: A.S.T.M. Designation: D 97-39. *Unsulfonated Residue*: A.S.T.M. Designation D 483-40.

Top Photo: Effect on apple buds of 3 percent oil applied in delayed dormant stage. (5 days after treatment) Top row, no treatment; middle row, "regular" dormant oil; bottom row, "superior" dormant oil.

Lower photo shows amount of hatching in leaf roller egg masses treated with lethal and sub-lethal doses of oil. Bottom row was untreated.

insecticidal action. It seems doubtful that viscosity *per se* is a primary factor in such action. For example, the writers have found that a hydrocarbon composition having a viscosity of 50 seconds Saybolt at 100°F. may be more effective than another of 130 seconds viscosity.

What is involved here, ultimately, is the size and configuration or shape of the hydrocarbon molecules present in the product. Viscosity is dependent on both molecular size and structural constitution. In dealing with products where the configuration is essentially constant—that is, the same crude base—viscosity provides a practical measure related to molecular size. A serious limitation is that it shows only the average size. It offers no clue whether the product is a narrow straight run fraction or is a blend of light and heavy fractions. Great differences in insecticidal value could exist between two such products.

Another method available for providing an indication of molecular size and particularly of size-range is the determination of boiling or distillation range of the oil. Some years ago, the California Department of Agriculture set up a classification of spray oils involving this principle. It is based on the percentage of the oil that will distill over at 636°F. As with viscosity, this is an approach, and a nearer one too, to selecting spray oils according to their molecular size. The adoption and application of this classification in California marks one of the major advances made in the development of spray oils. It brought about a greater degree of standardization in the use of oils in that state than exists elsewhere.

Molecular Size

WITH spray oils as with oils used as lubricants, we are concerned with their proper "heaviness." The trend has been to use the "lighter" oil that will give the desired insecticidal action at reasonable concentrations. This is a result of experience over the years which indicates that the lighter the oil, within the spray oil range, the safer it is to use on oil sensitive plants.

From a long range viewpoint, however, we have not approached very closely to the ideal with respect to molecular size in spray oils. In the opinion of the writers, it is important that this field be explored for in this direction may lie at least partial solutions to our plant injury problems.

In some recent studies made by the writers, several conventional spray oils have been divided into ten and in some cases, twenty fractions through vacuum distillation. Tests made with these very narrow fractions revealed that from a third to a half of the "mother" oil was too light and had little if any insecticidal value. Similarly there was no advantage found insecticidally, above a certain "heaviness" or viscosity. This latter finding was illuminating since the heavier portion of a spray oil has been suspected of being at the bottom of plant injury troubles owing to its long persistence on the plant and resistance to weathering. This work suggests that more efficient and possibly safer products would be produced if one could approximate the ideal in molecular size.

Although viscosity and some arbitrary distillation classification such as is used on the west coast serve a useful purpose, these properties fail to define the fundamental composition of an oil to which our studies show insecticidal action is basically related. More information is needed on these basic relationships for other pests and under varying climatic conditions.

While knowledge in any field will always remain imperfect, there is that final practical question: what is the best product to use in the light of present knowledge? The writers feel qualified to answer that question only for dormant oils under conditions existing in New York.

Oil Specifications

SPECIFICATIONS for dormant oil were first established five years ago. These have now been modified, or rather, added to, by specifying two types of dormant spray oils. Both are given in Table 2.

These specifications define an oil of a moderate degree of paraffinicity for the "regular type" and a more highly refined, highly paraffinic oil for the "superior type." Both types of oils have been widely used by growers in New York both in tank-mixing and in the form of commercial spray concentrates.

Increasing interest is being shown in the so-called "superior class" oils. These are intended for use primarily after growth starts, that is, for apple in the green-tip and delayed dormant stage (when the leaves in blossom buds are exposed ¼ to ½ inch.) They may also be employed as full dormant sprays if desired.

The use of oil in this semi-dormant period is favored for the reasons that (a) the over wintering eggs of the European red mite are more readily killed at this time (b) it permits the use of a dinitro insecticide in a separate treatment. Under New York conditions, dinitro materials combined with oil and applied as a dormant treatment may cause serious tree injury. This risk is avoided by using the dinitro material in the dormant and the oil in the green-tip or delayed dormant application. In the 2 to 3 week interval normally separating the dormant and delayed dormant sprays, sufficient rainfall is almost certain to fall, under our conditions, to remove the dinitro residues since they are water soluble.

Applying dormant strength oils after a half inch of leaf growth has appeared entails an injury risk where the conventional dormant spray oil is used. True, such oils may not cause trouble every year, but the need for a safer product is indicated. This need is supplied by the superior type oils. These are not only safer to use on this new growth but are more effective in pest control. Altho such oils cost more per gallon than older types of dormant oils, this greater cost is largely equalized thru greater efficiency. And the value of the safety factor should be considered. The writers are not prepared to suggest specifications for dormant oils derived from asphaltic or naphthenic crudes.

Part II will appear in next month's issue.

DAMAGE caused by drifting insecticides applied to control pests has become a major problem for the agricultural industry during the past ten years. Rules and regulations were adopted during this period by the Department of Agriculture of the State of California, and several counties of the State in an effort, through legislation, to eliminate this problem. In practice, however, it has been found that the problem of drifting dust has increased in proportion with the growth of field crops requiring the use of insecticides for pest control. Regulation apparently has not been effective as a solution to this problem.

To undertake a comprehensive research program of investigation into new materials and methods, a committee was formed last May. Its assignment was to find toxicants suitable for the control of harmful pests but which will not cause the drift damage generally resulting from the use of existing materials. With the cooperation of Professor E. O. Essig, Division of Entomology and Parasitology, University of California at Berkeley, the following persons were named on the committee to undertake this project:

Dr. A. E. Michelbacher and Dr. W. W. Middlekauff both of the Division of Entomology and Parasitology, University of California, Berkeley, California; Professor O. C. French, Division of Agricultural Engineering, University of California, Davis; Stewart Lockwood, Department of Agriculture, State of California; Bernell Harlan, tomato grower, Woodland; Carl E. Rodegerdts, representing the Agricultural Airplane Operators Association and W. B. Parker, Chairman Entomologist for California Spray Chemical Corporation.

A research program was initiated during the summer of 1946 and from the preliminary results obtained, it is believed that an approach has been made to a satisfactory solution of the problem of eliminating damage caused by drifting insecticides. A discussion of the tomato pest control program and a summary of the 1946 investigation conducted by the committee follows.

* Authors Michelbacher, Middlekauff, and French are connected with the California Agricultural Experiment Station, Berkeley; Mr. Parker is field entomologist for the California Spray Chemical Corporation, Richmond, Calif.

Pests Attacking Tomato [1]

IN northern California, the more important pests attacking the tomato crop during the summer and fall are the tomato mite, tomato fruitworm,[2] hornworms, beet armyworm, western yellow-striped armyworm, tomato pinworm and the potato tuber moth.[3] These pests may cause serious damage, and in certain fields, complete loss of a crop may result if

1 The writers wish to thank the following University assistants for their help: O. C. Bacon, T. W. Fisher, W. H. Hart, H. T. Reynolds, W. S. Sibray and Arthur Walz. Thanks are also due George Bogart of the California Packing Corporation, Harlan and Dumars, Tomato Growers and H. H. Weggers, Airplane Dusting & Seeding Co.

2 On corn this insect is known as the earworm, and on cotton as the cotton bollworm.

3 The tomato pinworm and the potato tuber moth are not wide-spread throughout the tomato producing area of northern California. In certain localities however, they sometimes are very destructive.

TABLE 1

Amount of Infested Tomatoes in the Different Treatments in the Experimental Plots at Yolo, Yolo County

	PERCENT OF INFESTED TOMATOES								
	September 4 First Picking			September 23 Second Picking			October 7 Third Picking		
Treatment	Severe	Superficial	Total	Severe	Superficial	Total	Severe	Superficial	Total
10 gal., Calcium arsenate-water-oil suspension spray*	2.0	2.5	4.5	2.5	3.0	5.5	0.5	2.0	2.5
Check	3.0	4.0	7.0	8.5	6.0	14.5	4.5	11.5	16.0
7½ gals., Calcium arsenate-water-oil suspension spray*	1.5	1.5	3.0	3.0	3.5	6.5	1.0	2.0	3.0
5¼ gals. Calcium arsenate-water-oil suspension spray*	2.0	1.0	3.0	0.5	2.0	2.5	1.0	3.0	4.0
Regular commercial calcium arsenate program	1.5	0.5	2.0	1.5	2.0	3.5	2.5	3.5	6.0

* Composition of suspension—1 gallon oil emulsion, 3 gallons water and 12 pounds commercial arsenate. Two applications: August 7 and 28.

control measures are neglected. Calcium arsenate and cryolite dusts have been the two most important insecticides used to combat the caterpillars, while sulfur has been used to control the tomato mite. Investigations have shown that calcium arsenate is more effective against hornworms than is cryolite. This is one of the main reasons why the former is used more extensively than the latter.

Hornworms are likely to be found in the hot interior valleys. If hornworms are not controlled in such localities, there is a possibility that tomato fields may be severely injured or in some cases completely defoliated. Therefore, in order to reduce the injury to a minimum, calcium arsenate dusts have been used. Calcium arsenate is also effective against the other caterpillars attacking tomato, and because of the excellent control obtained, growers are very reluctant to change to cryolite. Most of the canning tomatoes are grown in the interior valleys, and as a result large quantities of calcium arsenate dust are used to protect the crop. The wide-spread use of calcium arsenate dusts has led to complaints from bee keepers and cattlemen. These protests have arisen not only as a result of faulty application, but also because of drift of the calcium arsenate dust to pollen and nectar plants, alfalfa fields and pasture land that surround tomato fields. Further, some injury has also been reported to occur where plants susceptible to arsenical injury are grown next to tomatoes.

Control Program Suggested

AN effective control program that gives rise to these complaints is as follows:

TABLE 2

Treatments, Compositions of Insecticides, and Rates of Application Per Acre.

Treatment	August 1 Application		August 23 Application	
	Composition of Insecticide	Approx. Amount Applied Per Acre	Composition of Insecticide	Approx. Amount Applied Per Acre
Check	84% sulfer 16% inert	25 pounds		
5% DDD	5% DDD 48% sulfur 47% inert	30 pounds	5% DDD 48 % sulfur 47% inert	30 pounds
3% DDT	3% DDT 50% sulfur 47% inert	40 pounds	3% DDT 30% sulfur 67% inert	30 pounds
5% DDT	5% DDT 50% sulfur 45% inert	40 pounds	5% DDT 30% sulfur 65% inert	28 pounds
Commercial calcium arsenate plus sulfur	50% calcium arsenate 23.4% sulfur 26.6% inert	25 pounds	50% calcium arsenate 23.4% sulfur 26.6% inert	25 pounds
Commercial calcium arsenate plus 2% oil	49% calcium arsenate 23% sulfur 26.6% inert 2% oil	25 pounds	49% calcium arsenate 23% sulfur 26% inert 2% oil	25 pounds
Calcium arsenate, oil, water suspension spray	1 gallon oil emulsion 2 gallons water 12 pounds commercial calcium arsenate	8 gallons	1 gallon oil emulsion 3 gallons water 12 pounds commercial calcium arsenate	8 gallons

1. Between July 1 and 15, a sulfur dust is applied to control the tomato mite. This dust may contain 25 per cent of commercial calcium arsenate directed against hornworms which are beginning to make their appearance. Depending upon the size of the vines, this dust mixture is applied at the rate of from 15 to 20 pounds per acre.
2. About the first of August a dust mixture containing 75 per cent commercial calcium arsenate and 25 per cent dusting sulfur is applied. This dusting is directed primarily against the beet armyworm and the yellow-striped armyworm, but will control horn-worms and any tomato fruitworms that are just beginning to appear. Depending upon the size of the vines, 20 to 30 pounds of the dust is applied per acre.
3. A third treatment is applied about August 25. If there is no evidence of the tomato mite at this time, a dust without sulfur can be used. This treatment is directed mainly against the tomato fruitworm, but will also give excellent control of the hornworms and any armyworms present. Undiluted commercial calcium arsenate should be applied at rate of approximately 25 pounds per acre.
4. Later dust applications may be necessary but these should never be made unless field surveys show that some of the small developing tomatoes are being infested with young tomato fruitworms. In any case, three to four weeks should elapse between treatments, because

TABLE 3

Amounts of Infested Tomatoes in the Different Treatments in the Experimental Plots at Woodland

Treatment	Per Cent of Infested Tomatoes											
	August 27 First Picking			September 14 Second Picking			October 7 Third Picking			October 28 Fourth Pickings*		
	Severe	Superficial	Total	Severe	Superficial	Total	Severe	Superficial	Total	Severe	Superficial	Total
Check	2.25	1.87	4.12	8.75	8.87	17.62	12.13	18.50	30.63	11.75	18.88	30.63
5% DDD	0.50	0.37	0.87	0.37	1.37	1.74	0.00	0.88	0.88	0.13	0.65	0.78
3% DDT	0.75	1.00	1.75	0.37	1.00	1.37	0.50	1.75	2.25	2.88	5.50	8.38
5% DDT	0.50	0.75	1.25	0.12	0.50	0.62	0.25	1.00	1.25	0.25	2.00	2.25
Commercial calcium arsenate plus sulfur	0.87	1.00	1.87	0.50	2.00	2.50	1.50	3.13	4.63	2.15	4.63	6.78
Commercial calcium arsenate plus sulfur plus 2% oil	0.75	1.00	1.75	0.37	1.25	1.62	1.75	3.75	5.50	1.65	4.50	6.15
Calcium arsenate, oil, water suspension spray†	1.00	0.75	1.75	0.62	1.50	2.12	1.00	1.13	2.13	1.13	4.25	5.38

* This picking was not harvested due to a killing frost that occurred on the morning of October 28.

† Composition: oil emulsion, 1 gallon; water, 3 gallons; commercial calcium arsenate, 12 pounds.

Drift of toxic materials presents a serious hazard in spraying and dusting. A committee has been studying the problem in California for the past several months. Their findings are presented here.

investigations have shown that where the dust is evenly and thoroughly applied, satisfactory control lasts at least this long.

From the foregoing program it is seen that from 3 to 4 dustings are necessary if a tomato crop is to be adequately protected from insects Even though the dust is carefully applied, some of it will drift from the field, and may cause damage to bees or livestock. The following precautions will help to reduce the hazard resulting from the use of calcium arsenate:

1. Substitute cryolite for calcium arsenate in some localities despite the fact that it is less effective against some caterpillars than is calcium arsenate.
2. Apply calcium arsenate only under the most favorable weather conditions.
3. Use the best available equipment. Tractor-mounted row crop dusters are more desirable than airplanes. However, power ground dusters are no guarantee against dust drifting.
4. Delay dusting until after an adjacent alfalfa hay crop has been harvested or until after an adjacent pasture has been thoroughly grazed. Where a tomato pest control program has been carefully followed and the dusts have been thoroughly and evenly applied, there is enough flexibility in the time of application to accommodate for the above situations. Closer cooperation between the tomato grower and his fellow farmers could facilitate such an arrangement.
5. Never apply calcium arsenate dusts unless the treatment is known to be necessary to protect the crop.

1946 Investigations

EVEN though calcium arsenate dust is applied under the most favorable conditions, there is always the hazard of drift. This has long been recognized as a serious limitation to this method of control, and in 1946 an extensive investigation was undertaken with the object in view of developing a control program which would eliminate this hazard. Cooperating in the study were several divisions in the California Agricultural Experiment Station, farmer groups, insecticide concerns, canners, airplane operators and the Extension Service.

Most of the investigations were conducted in Yolo County and were directed along the following lines:

1. To determine whether dusters could be equipped with hoods that would restrict drift.
2. To determine whether the incorporation of from 2 to 4 per cent of a highly refined oil in the calcium arsenate dust would settle the dust sufficiently well to eliminate a serious drift problem.
3. To determine the feasibiliy of application and the effectiveness of calcium arsenate applied as a concentrated spray.
4. To determine the effectiveness of such new insecticides as DDT (dichloro diphenyl trichlorethane) and DDD (dichloro diphenyl dichloroethane) in controlling the important pests of tomato.

A five-row tractor-mounted tomato duster was equipped with a seven foot adjustable rigid hood supplied with end and side drapes in order to test the efficiency of a hood in reducing drift. This duster was used on several occasions, but even under favorable weather conditions the hood proved to be ineffective.

In experiments where 2 and 4 per cent of a highly refined oil was incorporated in calcium arsenate dusts, little or no control of the drift was observed. It was found that the oil had a tendency to keep the drift from boiling high into the air but not to settle it. Although the drift cloud failed to rise to any extent above the ground, it did drift from the field being treated.

Experiments were conducted where commercial calcium arsenate was used in a concentrated liquid spray. The composition of the spray was as follows:

Oil emulsion..... 1 gallon
Water ..... 3 gallons
Calcium arsenate .....12 pounds

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Table 4
Yield of Tomato From the Different Treatments in the Experimental Plots at Woodland

Treatment	Total Acreage	Total Boxes	Boxes Per Acre	Approximate Number Tons Per Acre*
Check	3.36	2284.5	680.92	17.02
5% DDD	3.01	2977.0	989.69	24.74
3% DDT	3.21	2817.5	878.27	21.96
5% DT	2.93	2465.5	842.33	21.06
Commercial calcium arsenate plus sulfur	3.41	2955.0	867.92	21.70
Commercial calcium arsenate plus sulfur plus 2% oil	3.33	2932.0	881.80	22.05
Calcium arsenate, oil water suspension spray	3.09	2806.0	907.88	22.70

* On basis of 40 boxes to a ton.

Fertilizer Factory

General view of Chamberlain & Barclay buildings

WITH the vast increase in American fertilizer production during the war years, have come problems which at times have almost overwhelmed individual plants throughout the country. Shortage of chemical raw materials, shortage of equipment, shortage of bags, and shortage of labor have been four of the chief problems which practically every fertilizer manufacturer, large or small, has been forced to face, and still faces. In spite of the obstacles, plants have kept on producing and pushing their production upward to meet the larger and larger demands from the farmers. How they did it with the odds heavily against them, some are frank to state they do not know. Had they been called upon in advance six or seven years ago to estimate their top tonnage under war conditions, the figure in no instance probably would have been as high as actual output of the past several years. How they did it, they do not know,—but they did it.

To find out under today's conditions just what makes a modern fertilizer factory tick, and to find out how it has been operating over recent years, to look into their policies toward the farmer, to hear about sales methods and fertilizer problems in general, a visit was paid to the plant of Chamberlain & Barclay at Cranbury, N.J. This firm produces fertilizers for use by farmers in nearly all sections of that important agricultural state, and to a lesser extent by farmers in near-by states, Pennsylvania in particular. Located in central New Jersey, in the heart of the potato-growing region, most of the fertilizer they sell goes for use on this crop.

W. H. Gordon, vice-president of the firm and an old-time fertilizer expert, estimated that the potato farmers in Central New Jersey annually use about a ton of fertilizer per acre. Some farmers prefer one type, and others a variation in composition. To meet the varying preferences, the firm manufactures two grades of fertilizer, a 5-10-10 and a 4-12-8. Both are sold under the brand name of "Old Reliable." That the brand name is well chosen is attested to by the fact that New Jersey farmers have been buying it for over forty years and have come to rely upon the recommendations of the company as to when, where and how to use it as well as to the correctness of its composition for their specific uses.

One of the most consistent features of his firm's sales policies,

Soil Technologist L. Graham Campbell (center) discusses analysis of soil brought in by neighboring farmers. Campbell runs through as many as 1,500 samples of soil per season, with eight determinations to each sample. More than 2,000 specimens of soil are on "file" in the laboratory.

according to Mr. Gordon, has been to stay "down to earth" in dealing with farmers, to know their problems and to help them solve them on a practical basis. Even the physical lay-out of the plant appeals to the farmers, Mr. Gordon stated in showing their plain but neat frame buildings. This group from the outside might belie the fact that they housed a modern fertilizer factory, within which late model mixing and blending equipment, and bagging machines are turning out a large daily tonnage . . . a tonnage which has been reaching new highs repeatedly during the past few years.

In keeping with new records set by fertilizer manufacturers generally, Chamberlin & Barclay's output has practically doubled within the past few years. This was accomplished without additional buildings or floor space, Mr. Gordon reports, but some new machinery for mixing and bagging was installed a couple of years ago, he says. "Stepped-up production called for further co-operation from farmer customers," he continued, "But this was accomplished without any trouble. We deal directly with the farmers almost exclusively, and it wasn't hard to get them to buy their fertilizer early in order to clear our warehouses and enable us to work faster. That is about the only possible way we could increase production to any degree without additional buildings." He went on to say that production is continuing on a relatively good scale. Fertilizer is mixed at the rate of about 300 tons a day, a large part of which is trucked away by buyers residing within a 50 or 60 mile radius of Cranbury.

Great effort has been made over the years to gain the confidence of farmers in the area. Added to sound busines practices usually carried out by successful enterprises, this fertilizer company has maintained a soil analysis program as a service to the farmer. In charge of this phase of the business is L. Graham Campbell, soil technologist. Mr. Campbell, a graduate of Rutgers University of New Jersey, was formerly connected with the N.J. State Experiment Station at New Brunswick. While there he carried out a soil testing program for the farmers of that area, and later, upon joining the Chamberlin and Barclay firm, began a similar service at Cranbury.

At the present time, there are more than 2,000 different soil samples on "file" at the Chamberlin & Barclay laboratory, and farmers by the hundreds flock to the firm to have their ground analyzed and to receive recommendations for fertilizer. The practice has paid dividends, although no charge is made for analyzing. It has resulted of course in the sale of many extra tons of fertilizer, but of more importance in the long run, it has also established good-will and confidence among customers and potential customers. Mr. Gordon points out that no pressure of any kind is exerted on the farmers to buy fertilizer, nor to purchase it from Chamberlin and Barclay if it is needed by the soil in question. However, an overwhelming majority of the farmers do follow the course indicated by the soil analysis, and

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Customers residing in a 60 mile radius from Chamberlin & Barclay plant drive trucks to Cranbury to pick up loads of fertilizer. Typical scene of long line of trucks awaiting turn to be loaded. Output of factory is around 300 tons daily. Most of production is trucked out promptly.

"Speed Spraying"

An Improved Method of Applying Orchard Sprays

by

Ralph V. Newcomb

Entomologist,
DiGiorgio Fruit Corporation

THE principle of using an air blast as a carrier for tree sprays has often been tried and used in several forms. Results have shown varying degrees of effectiveness. However, the basic principles involved have been overlooked or not understood in nearly every case with the result that the full effectiveness and efficiency of this method has not been recognized until recently.

These basic principles consist of three major factors, including: (1) sufficient air volume to provide rapid and complete re-placement of the air in and around each tree with spray laden air: (2) high enough air velocity to disturb or set in motion the foliage and smaller twigs which mask a large part of the area to be covered; and (3) uniformity of air pattern to provide thorough coverage for any type or size of tree.

These three principles along with other mechanical and design refinements have finally been incorporated in machines now in use in northern California. There are now eight such machines being used in spraying pears, peaches, plums and nectarines. Under favorable operating conditions (i.e. good weather and short refill hauls), this equipment can apply sixty 500 gallon tanks of spray in ten hours, or 30,000 gallons for each machine.

To assure continuance of the work, three refilling tanks drawn by wide wheel tractors are used to supply two sprayers. The sprayer pump, a high capacity centrifugal type, is used to refill the spray tank, an operation which requires but two minutes. One man drives the tractor as it pulls the sprayer, and all sprayer controls are handled easily by him.

The patented sprayer consists of a 500 gallon tank provided with jet or hydraulic agitation, and a 100 H.P. engine which turns a 48" diameter, four blade air screw inside an aerodynamically designed housing. By this means approximately 60,000 cubic feet of air are discharged per minute through a patented spray head at a mean velocity of 82 miles per hour. The discharge is made at right angles to the direction of travel. Spray materials are introduced into the air blast through nozzles set in pipe rings around the discharge outlet. The machine discharges spray to both sides and excellent coverage is obtained by regulating the speed at which the sprayer is drawn past each tree. The rate of speed is determined by the amount of foliage and size of tree, since large, dense trees require much more air than small or open trees. The question often arises as to how many acres this machine will spray in an hour. The answer depends entirely upon the type of trees to be treated. Obviously trees requiring five gallons of spray and 10,000 cubic feet of air will permit faster travel and a greater acreage sprayed than ones requiring forty gallons of spray and 30,000 cubic feet of air.

Photo above: Improved "Speed Sprayer" demonstrating range and distribution of spray-laden air. Such machines are used in spraying pears, peaches, plums, and nectarines on West Coast.

After three years of experimentation and application the writer has supervised the application of some 45 million gallons of sprays of all kinds during both dormant and growing seasons. Throughout this period these machines have shown substantial savings in labor costs and have given a spray coverage far superior to other applicators. These machines, in addition to doing effective jobs of spray-

ing, actually require less material for an equivalent coverage than the conventional sprayer of the high pressure type.

Many attempts have been made recently to build sprayers using air as a spray carrier, but so far such machines seem unable to match the completely "automatic" effectiveness and high capacity of the improved "speed sprayer." This "automatic" type of application makes night spraying as effective and thorough as that done in daylight since the only regulation required is the rate of travel past each tree to provide the necessary coverage by the air blast alone.

Practically all insecticides and fungicides and combinations of these have been applied far better than by other methods. The so-called hormone sprays for prevention of abscission of fruit are applied by this method of application, and, even after pre-harvest drop has commenced, invariably fewer fruits are blown from the trees by the speed sprayer than by the use of conventional spray guns. Spider and rust sprays requiring a complete wetting of both upper and lower leaf surfaces are adequately applied by this machine. Highly concentrated sprays have been applied which require complete uniformity of coverage with very low gallonage per tree. With proper nozzle orifice variations a droplet size can be had which insures complete wetting with an absolute minimum of run-off or loss.

During the past two years of use and experimentation the improved "speed sprayer" has proven its ability satisfactorily to apply sprays in spite of wind or weather conditions which have quickly "blown out" or stopped application by other methods. This factor is important in areas where prevailing high winds continue during spraying seasons. A trial of the im-

(*Turn to page 63*)

PHOTOS: Top: Improved speed sprayer applying toxic materials on dormant Bartlett pear trees. Center side view of sprayer, showing comparative size compared to men beside it. Machine has 500 gallon tank for insecticide material. Lower photo shows machine at work applying spray oil on large citrus trees in California.

Chemical Therapy
for Plant Diseases

AGRICULTURAL chemicals for the control of plant diseases have generally been applied to the *outside* of plants to *protect* them against disease. The unexplored frontier of plant pathology is to apply chemicals *inside* the plant to *cure* plant diseases (chemotherapy) or to *prevent* them (chemical prophylaxis).

This approach to plant disease control is complex. It is complex because of difficulties of (1) differential toxicity to host and parasite and (2) distribution of proper quantities of chemical to the proper place at the proper time. Despite these difficulties, interest is slowly developing and results may confidently be expected from researches now being started. Not only are experiment station plant pathologists beginning to explore the field, but industry is also showing interest.

One of the intriguing aspects of internal treatment is that it may be applied to those plant diseases not amenable to seed treatment or spraying. The two outstanding classes of such diseases are the vascular diseases (diseases of the water system) and virus diseases. Neither has shown the slightest sign of control by spraying. The wilt diseases are among the best known vascular diseases. Most spectacular among these is the Dutch elm disease which has run amok among the elms of the Northeast during the last dozen years. There are also serious wilt diseases of many other plants: cotton, banana, tomato.

There are virus diseases of all parts of the plant including the vascular system, but they, like the vascular diseases, are inside the plant and hence not amenable to control by spraying.

The story of tree injection dates back many years. Roach (1939) in England says that Ibn-al-Awam in the twelfth century described methods for injecting perfumes into peaches to improve the odor. Leonardo da Vinci, the famous Italian artist and scientist, toyed with the idea and described a method for tree injection. Roach also quotes a writer in 1602 who suggested that "wormes, which grow into the tree can be killed by boring downward into the pith and filling it with pepper, laurell, and incense." Modern entomologists say that extracts of both laurel and pepper possess insecticidal properties.

Recent Successes

1. *Deficiency diseases.* Until quite recently the only real success credited to chemotherapy was the cure of *deficiency* diseases. In New Jersey, for example, oak trees suffering from a leaf chlorosis disease are cured by injection of iron salts. Zinc is injected into citrus and tung trees to cure diseases due to deficiency of this element. This aspect of chemotherapy will not be the subject of this story, however.

2. *Infectious diseases.* In this paper we shall deal with the research on the internal treatment of infectious diseases which we and our colleagues are doing or have done at the Connecticut Agricultural Experiment Station.

a. *Virus diseases.* In the test tube, viruses can be inactivated by heat and certain chemicals. It is logical that if a virus can be inactivated in the test tube, it should be possible to inactivate this same virus in its host plant. The search for chemicals to inactivate viruses in the host was a task which E. M. Stoddard assigned himself as a means of controlling the X disease of peach. His investigations begun in 1935, have continued to the present and some of his published results will be reviewed here.

b. *Vascular diseases.* Our recent emphasis on the chemotherapeutic approach to vascular diseases was stimulated by the work of Howard of the Rhode Island Agricultural Experiment Station (1941). Working with a disease of maples known as bleeding canker, he showed that the causal organism produces compounds poisonous to the tree and liberates these compounds into the water stream. These poisons are chiefly responsible for the symptoms of the disease. He further showed that an orange dyestuff, Helione orange, technically known as "diamino azobenzene dihydrochloride," counteracted these poisons when it was injected into the sick tree. This discovery marked the rejuvenescence of the chemotherapeutic approach to plant diseases.

Possible Mechanisms of Chemotherapy

BY definition, chemotherapy is the cure of disease—in this case plant disease. The term was coined by Ehrlich in his classical researches on organic compounds of arsenic for syphilis. At present we have very few cures for sick plants. Strong and Cation (1940) cured cedar trees diseased with rust galls by applying

by

Dr. James G. Horsfall,
E. M. Stoddard and A. E. Dimond

sodium dinitro-*o*-cresylate to their surfaces, and seeds are sometimes cured of infection by treatment with an organic mercury compound.

Of course if the treatment is introduced into the plant before inoculation occurs, or before the parasite enters the host, then the situation is best classified as chemical prophylaxis. The distinction between prophylaxis and therapy is probably a matter of time. The mechanisms of effecting prophylaxis may well be equivalent to those of therapy.

A. *Chemical prophylaxis.* In nature, the resistance of some plants to disease is due to a chemical constitutent which is toxic to the parasite. The classic example, discovered by Walker and Link, is protocatechuic acid, the red pigment in the scale which makes the red onion immune to the smudge disease. The white onion, lacking this pigment, is attacked by the disease. There is no reason why we must depend upon nature to supply such chemical immunity. Why not supply the chemical when nature fails to do it?

B. *Chemotherapy.* The more direct approach is to use chemicals to cure rather than prevent disease. Such a chemical must be highly specific. It must kill or prevent growth of the parasite without seriously injuring the host plant. This type of chemotherapy may be described as *antiparasitic*. Chemotherapy of X-disease appears to be of this type.

The second type of chemotherapeutic activity depends upon neutralizing the poisons formed by a parasite as it grows in the host. Such mechanisms may be described as *antipathogenic*. Chemotherapy of bleeding canker of maple by diaminoazobenzene dihydrochloride and of Dutch elm disease by oxyquinoline benzoate may be *antipathogenic*.

Evidence for Chemical Prophylaxis

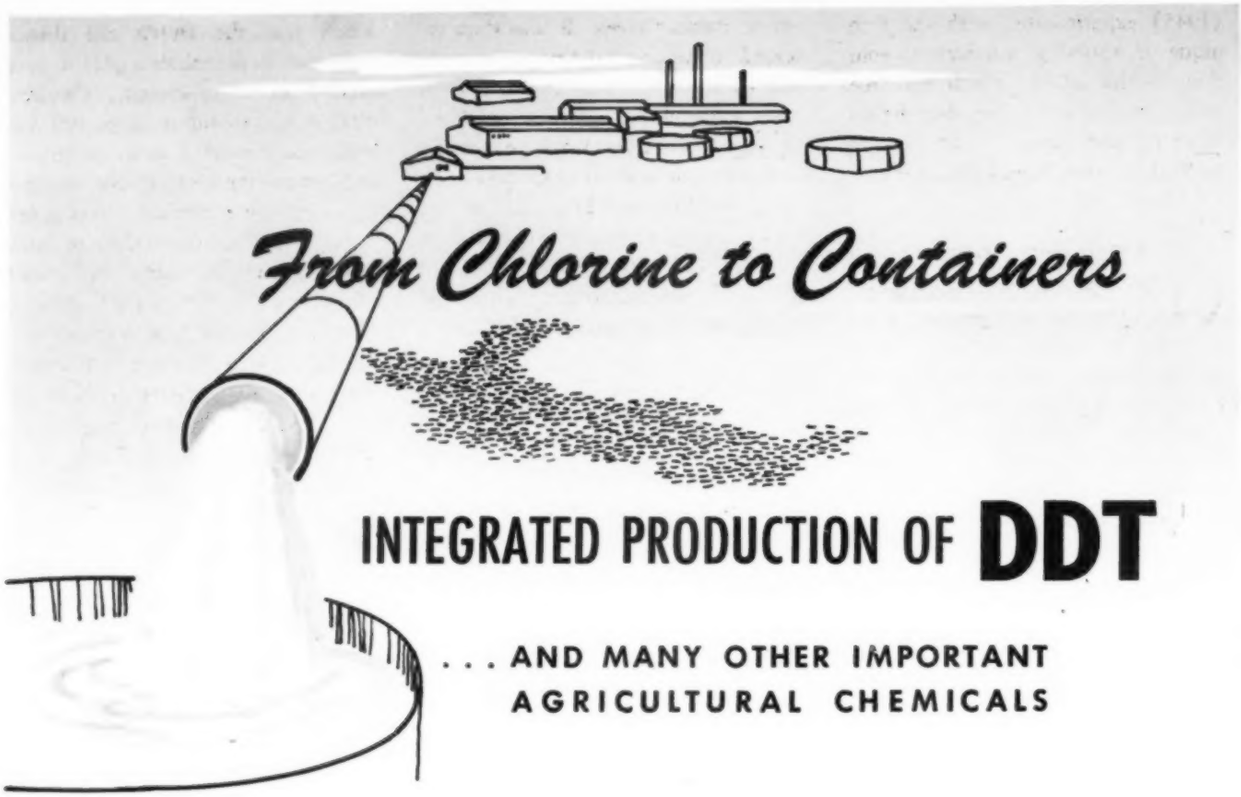
WE present our result to a general readership with some trepidation because such results are not yet definite. They are still in the raw experimental stage. The results with X disease of peach have been more conclusive than those with Dutch elm disease. None of the chemicals used has reached commercial adoption, but a few have reached pilot plant commercial trial.

X Disease of Peach

IN 1941 Stoddard reported the first case of chemical cure of a plant virus disease—perhaps the first cure of any virus disease. Working with X disease of peach, he soaked diseased buds in oxyquinoline derivatives, *p*-nitrophenol, quinhydrone and hydroquinone. After being budded into healthy trees, a high percentage of the buds grew healthy and failed to transmit the disease. Untreated buds not only grew diseased, but also transmitted the virus to the stock.

Stoddard (1944) reported the results of work in which chemotherapy was subjected to a more drastic test. Diseased buds were grafted into healthy seedling trees. These trees were then injected with solutions of chemicals through the cut upper end of the main stem. When p-aminobenzene sulfonamide was injected at concentrations of 0.05% it *prevented completely* infection of all of a lot of 45 trees. Eighty-five per cent of untreated control trees became diseased. The injected trees remained healthy at the end of a two year period of observation. Other chemicals were also found effective. For example, zinc sulfate injected into plants resulted in 80 to 85 per cent control of X disease. 8-Hydroxyquinoline sulfate gave a like protection. Lauryl isoquinolinium bromide gave 85% control. Either maltose or dextrose solutions gave 80% control. Good results were obtained with sulfaguanidine, sulfathiazole and hydroquinone solutions injected into trees, the control in these cases being from 90 to 100 per cent.

Subsequent to this, Stoddard



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(1945) experimented with the technique of applying chemicals in solution to the soil in which the trees were growing and found that the soil watering technique was an effective method of introducing the chemicals into the plant.

Dutch Elm Disease

OUR research on chemotherapy of vascular diseases was begun in 1940 by Horsfall and Zentmyer. Several maples diseased with *Verticillium* in the water stream were injected with 8-hydroxyquinoline sulfate. More were treated in 1941. There did not seem to be much alleviation of symptoms in the current year, but treated trees leafed out with greener and larger leaves than the checks the year after treatment.

Field work on the Dutch elm disease prior to 1942 was not possible because of the efforts to clean out all diseased material and it was hampered by the war after 1942. Still some research was conducted—enough to show the promise of several chemicals. This research has been summarized by Zentmyer *et al* (1946).

Of the chemicals applied to trees before inoculation, the following gave considerable protection: 8-hydroxyquinoline sulfate, 8-hydroxyquinoline benzoate, hydroquinone, *p*-nitrophenol, benzoic acid and disodium ethylene bisdithiocarbamate. When injected after inoculation but before the appearance of symptoms, these same chemcals plus pyrogallol and quinone showed promise. Disodium ethylene bisdithiocarbamate was not included in the second list.

Hydroquinone and *p*-nithrophenol, despite their repeated promise, were of little practical value because of the damage to the tree. They and their derivatives need further work, however. 8-tydroxyquinoline sulfate seemed impractical because the results were more evanescent than with 8-hydroxyquinoline benzoate and this in turn seemed on the average to be more effective than quinone, pyrogallol or disodium ethylene bisdithiocarbamate.

At any rate, oxyquinoline benzoate was given a larger scale trial in 1945 and it continued to show promise on nursery trees. It was then released to commercial tree experts for limited trial in 1946. The data from such trials will be slow to come in, of course, because there we are depending upon natural inoculation. At the present writing little can be said about the early commercial trials. A few treated trees have died. Hence the treatment cannot be said to be foolproof at the present time.

In one trial of our own on large trees in 1946, one hundred nontreated and one hundred trees treated with 8-hydroxyquinoline benzoate were inoculated with giant doses of spores applied in axe cuts in the stem. Results were as follows: Treated trees showed 27% crown involvement for the check trees three weeks later, as contrasted with 49%.

It can be seen that the treatment did not prevent successful inoculation to any marked degree under these very drastic conditions, but it did markedly reduce the degree of involvement of the trees. The hope is that the treated trees will not die as easily as the untreated trees during the winter of 1946-47. Unfortunately, as yet it is too early to tell.

It will be noted that fair results are possible in preventing infection by X-disease, but the best so far on Dutch elm disease is to ameliorate symptoms. Nevertheless, it seems that the Dutch elm disease, tough as it is, shows signs of being cracked by chemotherapy. Oxyquinoline benzoate surely is no final answer. It is only a step, probably a very stumbling step, in the direction of the proper chemical. It is a very expensive chemical. Despite these points against it, many tree owners are demanding that their elms be treated. Even though they know it may be only a straw to a drowning man, they seem willing to grasp it.

Although chemotherapy has not given us commercial control of plant diseases yet, our toast to the workers in this field is: "Here's to good hunting!★★

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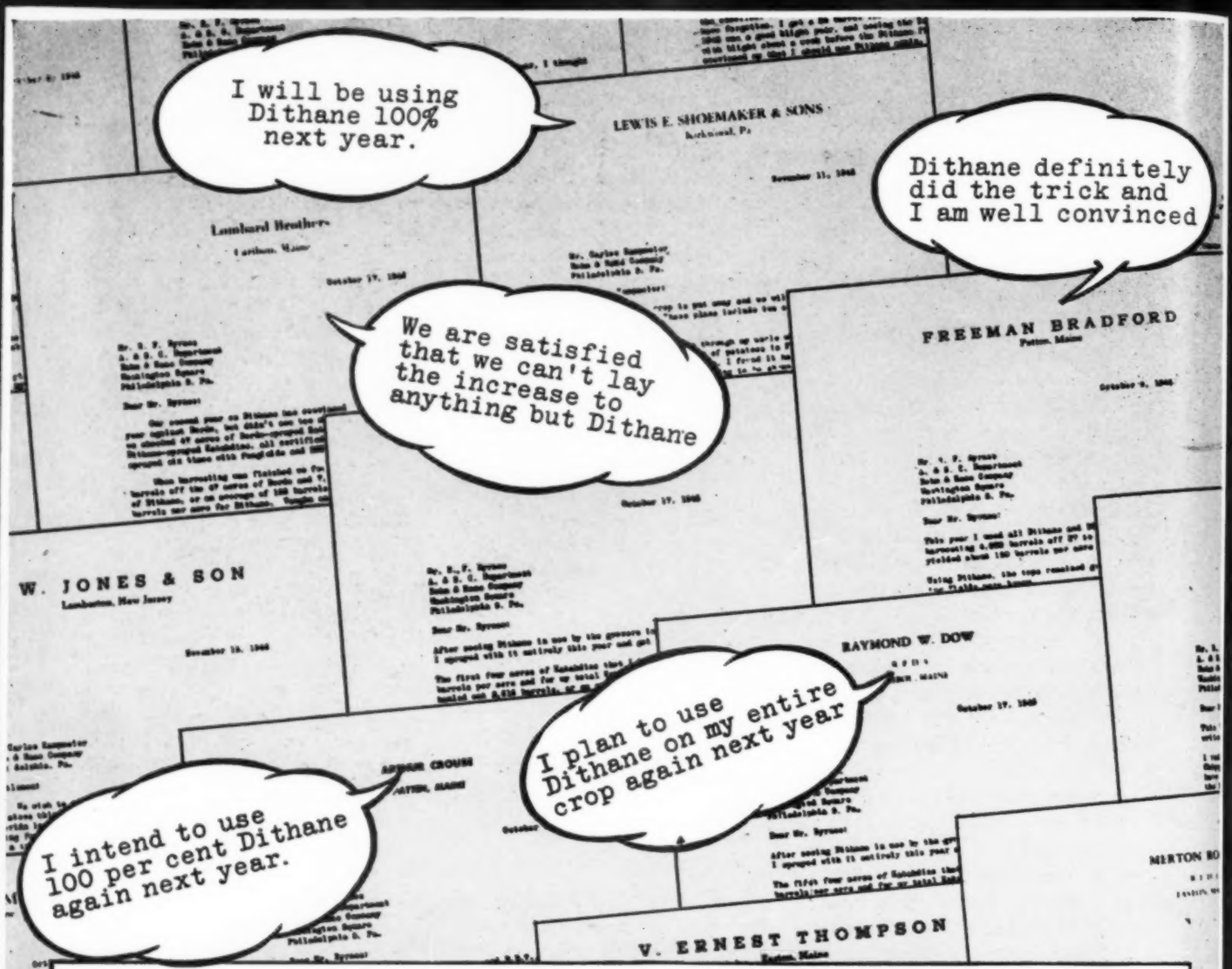
Diseases resistant to spraying respond to chemotherapeutic treatments. Both vascular and virus diseases being studied . . . of the former, Dutch elm disease is best known, though others take heavy annual toll in U. S.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		With DITHANE	With other fungicides	
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Fort Kent	Katahdins, Chippewas	555	480	75
Caribou	Katahdins	573	480	93
Easton	Green Mts.	541	486	55
Caribou	Katahdins	585	474	111
Easton	Katahdins	540	444	96
Limestone	Green Mts.	645	471	174

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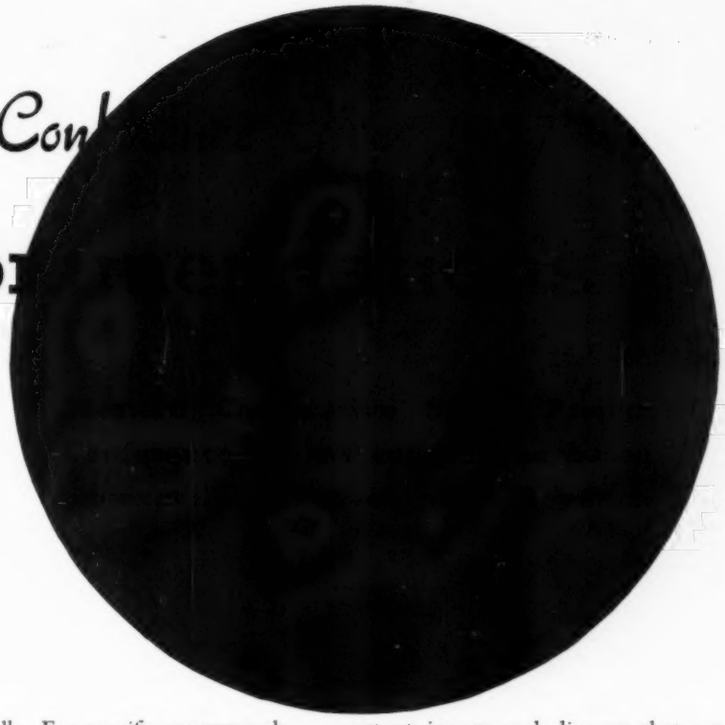

MEMBERS of the Western Cooperative Spray Project, comprising the experimental stations of California, Idaho, Montana, Oregon, Washington and British Columbia, the Colorado Division of Agriculture and the United States Department of Agriculture, made the following suggestions regarding the use of sprays on tree fruits at the Portland Conference, January 22 and 23, 1947. These suggestions are based on data accumulated from twenty years of experimental work.

Results of three successive years of extensive orchard and semi-commercial experimentation have established the outstanding effectiveness of DDT for codling moth control. Seasonal use of DDT for this purpose may be expected to result in one or more of the following complications.

1. Increase in population of several species of mites with consequent severe injury.
2. Increase in population of woolly apple aphids which will in turn increase damage from perennial canker.
3. Seriously handicap or nullify the Pear Psylla eradication program by Federal Entomologists.
4. Creation of new pest control problems with insects which at present are of little or no economic importance.

DDT on Apples and Pears

FOR the guidance of orchardists who propose to use DDT in 1947, experiments to date would suggest the following:

1. DDT should be used at 1 lb.[1] for the first application. Further applications and timing will vary in different districts. The concentration for these should be from ½ to 1 lb. For specific recommendations consult local authorities.

   A working program, at the present time, suggests the following:

First application	**1 lb. DDT**
Second application	**½ lb. DDT**
Third application	**1 lb. DDT**

   This procedure to be modified as conditions warrant.
2. Effective control of codling moth with DDT is dependent on thoroughness of application.
3. The inclusion of an acaricide in all DDT applications appears warranted. No single program for mite control can be suggested due to the various species of mites involved and the incomplete information relative to many materials being offered at this time. The application for mites must be especially thorough.
4. The advantages of a DDT program may be nullified by failure to control mites. For successful mite control the program must be started early and continued throughout the period of mite activity. A successful program is dependent on prevention of an infestation. Control is difficult after a severe infestation develops.
5. The program suggested above, should present no DDT residue problem.

The spray program should be planned early to control the most important insects and diseases that are present in the orchard. Growers should anticipate needed materials and place their orders well in advance. New spray materials and spreaders appear on the market each year. We advise strongly against the extensive use of any new product until its worth on tree fruits is proved.

WHETHER oil emulsion or lime sulfur is used as a dormant application depends on the insects or fungous diseases to be controlled. In limiting the damage from certain pests or diseases, dormant oils should be alternated with lime sulfur where advisable in order to hold in check the increase of those pests or diseases that may develop from the annual use of either spray alone.

For dormant applications the oil should be used at not less than 3.2 per cent actual oil (ordinarily 4 gallons of commercial emulsion or 5 gallons of homemade emulsion per 100 gallons). Oils of 100 to 120 viscosity and relatively low sulfonation test* (50-70), can be safely used, and there seems to be no need for further modification in distillation range.

For dormant use, liquid lime sulfur (32° B.) should ordinarily be

[1] All dosages of DDT in this report refer to actual DDT.

* Whether this term should be used rather than "unsulfonatable residue" is a matter to be decided at the next meeting of the group.

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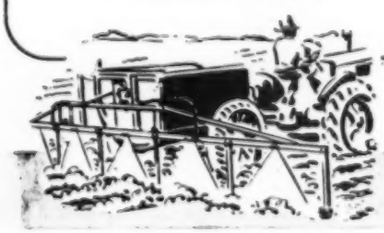

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TABLE I
Dormant Sprays

Dormant sprays of petroleum oil, lime sulfur or their mixtures have been found to be effective in the control of pests as listed below:

Insect or Disease	Dormant oil[1]	Lime Sulfur[2]	Lime Sulfur-Oils[3]
San Jose Scale	Good	Good	Good
Oyster Shell Scale	Fair	Poor	Good
Woolly Aphids	Slight	Poor (unless nicotine sulfate added in delayed dormant)	.....
Rosy and Green Apple Aphids	Good (only when used in delayed dormant)	Poor (unless nicotine sulfate added in delayed dormant)	Good[3]
Aphids (on plums and prunes)	Good (only when used in delayed dormant)	Poor (unless nicotine sulfate added in delayed dormant)	.....
Tree Hopper	Partial	No control	.....
Pacific Mite	No control	Of little value	.....
Willamette Mite	Partial (if delayed)	Of little value	Partial (if delayed)
European Red Mite & Brown Mite	Good	Partial (when applied after eggs hatch or just previous to hatching)	Good[3]
Rust Mite	No data	Variable	.....
Blister Mite	Variable	Good	Good
Fruit Tree Leaf Roller	Good	No control	.....
Pear or Prune Thrips	No control	No control	Partial (if delayed)
Coryneum Blight of Stone Fruits	No control	Good (if used[4] annually)	.....
Apple Pear Scab	No control	Partial (delayed dormant)	Partial (delayed dormant[3])
Powdery Mildew (Apple or Pear)	No Control	Partial (delayed dormant)	.....
Green Peach Aphid	Good	Good (only when nicotine added)	.....
Peach Twig Borer	Good (if 2% oil used as delayed dormant with lead arsenate)	Good (delayed dormant[4])	.....
Peach Leaf Curl	No control	Partial[4]	.....

1 See "Dormant Sprays," Page 33.
2 See 1st paragraph, this page.
3 See first paragraph, this page.
4 See columns 2 & 3 this page.

used at dilutions of 11 gallons to 100 gallons of spray. (See Standard Dilution Table). The use of 1% actual oil (dormant type) and 3% liquid lime sulfur or an equivalent amount of dry lime sulfur has given satisfactory control of San Jose scale and blister mite. Only paste or flowable type emulsions are recommended at this time. Oil should be increased to 2% actual oil to control rosy and green aphids and European mites. Where pear scab and thrips are a problem, a mixture of 2% actual oil and 6% liquid lime sulfur is recommended.

Oil emulsion, lime sulfur or the mixture of the two used for scale insects should generally be applied in the spring, preferably before the bud scales separate and before the bud tips show green. In sections where certain fungous diseases and aphids are a problem, it is desirable to apply these sprays in the delayed dormant period. Due to present shortage of nicotine, delayed dormant oil applications are more important.

There is no evidence that low temperature following oil, lime sulfur or their mixture applied as strictly dormant sprays will result in injury. Injury may result if oil emulsions are applied during the critical period of bud development, particularly where this period is followed by slow growing conditions due to cold weather. This period occurs between the time the buds first show green and the cluster bud stage. Lime sulfur may produce injury in the arid interior districts if followed by hot weather.

Apricot foliage is particularly susceptible to lime-sulfur injury. Severe injury to Delicious buds may result if lime sulfur at dormant strength is applied as a delayed dormant spray. The use of dormant oil may injure buds of Winter Nelis pears. If a delayed dormant spray of lime sulfur is used, no summer oil should be applied within 60 days because of probable fruit drop and foliage injury.

DDT used at the dilution of ¼ pound in solvents or ½ pound in water dispersible form applied when 50% of the buds are in the green tip stage is recommended for the control of pear and prune thrips. Limited studies involving timing make positive statements difficult. In some experimental tests, DDT used at dilutions as low as 2 oz. to 100, resulted in effective control. A 5% DDT dust is suggested for the control of adult thrips on pears and prunes.

For the western 11-spotted cucumber beetle on soft fruits use 3% DDT and 97% sulfur (325 mesh) two weeks before harvest date for particular variety being protected.

Bordeaux mixture (12-6-100) as a dormant spray is preferred for control of peach leaf curl and should be applied before the buds swell, and west of the Cascades before January first. Two quarts of oil emulsion or other effective material may be added to the Bordeaux mixture as a spreader and sticker. Lime sulfur, 8 gals. to 100, may be used to control peach leaf curl and San Jose scale if applied before the buds swell. Lime sulfur is not recommended west of the Cascades because of occasional injury. Also see "Dormant Oil," table I.

Summer Sprays

TO avoid unnecessary poisoning of bees and other pollinating insects, the following recommendations are made: Insecticides should not be applied during the bloom period until 80% to 90% of the petals have fallen. Bee hives brought into the orchards for pollination purposes should be removed before the calyx spray is applied. Beekeepers should remove hives before the spray season and fruit growers should delay the calyx spray as long as possible in orchards located within two miles of an apiary. Further recommendations include:

1. Summer applications of petroleum oil are chiefly used for controlling spider-mites, and in mixtures with other insecticides for codling moth, leafhoppers, and aphids.
2. Spider-mites may cause severe injury to fruit trees. Infestation frequently begins on foliage in the lower framework. It is important

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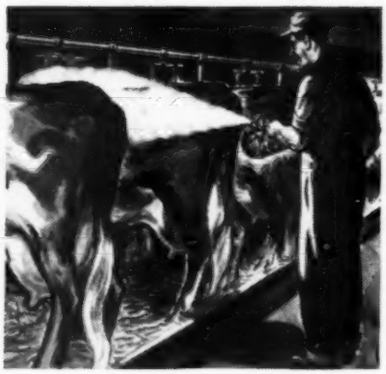

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to check these pests by thoroughly spraying the trees on the lower inside area before infestation becomes general.

3. When sulfur is used in pink or calyx sprays, no oils should be used less than 30 days thereafter. Oils are not necessary in the calyx spray on apples. If used at ovicidal concentrations, oils applied in calyx or first cover spray may cause severe dropping of foliage and fruit even though sulfur has not previously been used.
4. Lime-sulfur, 2 gal. to 100 gal. (or 1½ pounds "Fermate" or similar material) has given satisfactory control of leaf spot on sour cherries when applied at petal fall, shuck fall, and two weeks later. Four pounds of lead arsenate added to the petal fall or shuck fall applications or a 5% DDT dust may be used to control Syneta beetle.
5. For cherry fruit fly control on cherries intended for the fresh fuit market use 1½ qts. rotenone solution (2½% active ingredient) or 3 lbs. ground derris root (4% rotenone) to 100 gal. of water. A spray should be applied soon after the fruit flies appear and a second one week later; a third spray applied one week after the second spray may be necessary in case of severe infestation. For cherries to be sold for processing, 2½ lbs. of lead arsenate plus a suitable amount of spreader or sticker may be substituted for rotenone.

   Lead arsenate sprays should be applied when the first flies appear and at intervals of two weeks until the fruit is harvested. For brown rot and cherry fruit fly a dust consisting of 90% sulfur (325 mesh or finer) and 10% lead arsenate may be used on sweet cherries in place of the spray.

   In some areas, particularly east of the Cascades, this procedure may be varied. Consult local authorities.
6. "Fermate" (1½ pounds to 100 gallons) has given satisfactory control of brown-rot blossom and twig blight on peaches when applied (1) when first blossoms are open and (2) at full bloom.
7. "Fermate" (1½ pounds to 100 gallons) has given good control of pear and apple scab when substituted for wettable sulfur in the cover sprays. "Fermate" is recommended on tender skinned varieties of pears such as Anjou and Comice.
8. Oil in late season applications makes residue removal more difficult.
9. Cryolite with petroleum oil or suitable spreaders, when used in cover sprays has proved satisfactory for codling moth control as an alternate material.
10. A tandem washer is frequently necessary for the removal of lead and fluorine residues when late season sprays have been applied or wax development on the fruit has started.
11. Petroleum oils of definite specifications are recommended. It is important that fairly close cut oils be used in the preparation of oil sprays. Blends of extra heavy and light fractions should be avoided. Oils classified as "Light," "Light-Medium," and "Medium" should come within the following distillation-range specifications:

Classification of Petroleum Oils

Light:

64-79% of oil should distill at			636° F.
Not more than 10%	"	"	520° F.
Not less than 80%	"	"	665° F.

Light-medium:

52-61% of oil should distill at			636° F.
Not more than 10%	"	"	530° F.
Not less than 80%	"	"	715° F.

Medium:

40-49% of oil should distill at			636° F.
Not more than 10%	"	"	540° F.
Not less than 80%	"	"	725° F.

12. Petroleum oil used with lead arsenate or cryolite has given best results when applied at the height of the egg-laying period. (See No. 3 and No. 13.) In this connection a light or light-medium oil has proved satisfactory. As an ovicide in codling moth control, oil should be used at the rate of ½ to ¾% actual oil, depending on classification, as above, and rate of application, and the lead arsenate or cryolite should be used at the rate of three pounds to 100 gallons.

    If mites are present, the quantity of oil should be increased to ¾% of light or medium oil having a sulfonation test of at least 90. On pears, 1% of light-medium oil, with the same sulfonation test, may be used. (See No. 8)

    If the oil is used as a spreader-sticker only, one quart per 100

Dilution of Concentrated Lime-Sulfur Solutions for Various Strengths of Spray (from U. S. Department of Agriculture Circular 270)

Strength of concentrated lime-sulfur		Quantity[1] of concentrated lime-sulfur required to make 100 gallons of spray solution			
Degrees Baumé	Specific gravity	Dormant strength for scale (4½° Baumé)	Dormant strength for blister mite and twig borer (3½° Baumé)	Early Spring strength for scab and red spiders (1½° Baumé)	Spring or Summer strength for mildew and red spiders (1° Baumé)
		Gallons	Gallons	Gallons	Gallons
36	1.330	9½	7	2¾	1¾
34	1.306	10	7½	3	1¾
33	1.295	10½	7¾	3	2
32	1.283	11	8	3	2
31	1.272	11¼	8¼	3	2
30	1.261	11½	8½	3¼	2
29	1.250	12	9	3¼	2¼
28	1.239	12½	9½	3½	2¼
26	1.218	13½	10	3¾	2½
24	1.198	14¾	11	4¼	2¾
22	1.179	16½	12½	4½	3
20	1.160	18¾	14	5	3½

[1] All quantities expressed in nearest quarter gallon.

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gallons is sufficient.

13. From the standpoint of injury, oils having a sulfonation test of not less than 90% have been satisfactory. However, light-medium oil has produced injury to Newtown apples and other susceptible varieties. A light oil, therefore, is recommended for these susceptible varieties and the number of applications should not exceed two. Oil sprays interfere with leaf metabolism, and the number of applications that can be given without retarding or checking the normal development of the fruit and fruit buds is limited by such factors as heavy fruit load on the trees at the time of application; lack of sufficient water and plant food available in the soil; high temperatures combined with high humidity at the time of application; poor health of the tree as to root injury.
Classification and concentration of the oil used should also be considered in determining the number of applications. Light oil having a sulfonation test of 90 or higher at concentrations of ½% actual oil or less can generally be applied without serious injury.

14. CAUTION: Spray materials should not be allowed to stand in pipes or spray tanks but should be applied immediately after being mixed. Fruit sprayed with oil mixtures after the spray has been allowed to stand in the pipes of stationary outfits for some time can be cleaned only with great difficulty. Broken oil emulsions should not be used.

15. Kerosene, stove oil and heavier oils, emulsified with soap, have given satisfactory results as stickers for lead arsenate or cryolite. Definite directions for preparation of these mixtures should be obtained from local authorities.

16. Most commercial spreaders and soaps when added to lead arsenate or cryolite sprays in suitable quantities produce a uniform coverage on the fruit. The mixture of soap and lead arsenate may cause serious injury. In general, it is advisable to use the particular spreader or deposit builder recommended by the manufacturer of the insecticide.

17. Peach twig borer may be controlled with basic lead arsenate or cryolite at 3 or 4 pounds to 100 gallons when applied when the trees are just past blooming.

18. In general, the shot-hole borer is not likely seriously to attack fruit trees in a vigorous growing condition. Trees whose growth is weakened from any cause may be subject to the attacks of this insect. There is no recommended spray for its control.

The following are members of the Western Cooperative Spray Project:

From British Columbia are James Marshall, Harry Andison, C. V. G. Morgan, Entomologists; H. R. McLarty, William Newton, G. E. Woolliams, Plant Pathologists; R. C. Palmer and Ben Hoy, Horticulturists, and J. M. McArthur, Chemist.

From California are A. D. Borden, M. P. Barnes, G. L. Smith, Entomologists, and C. E. Scott, Plant Pathologist.

From Colorado is J. H. Newton, Entomologist, and from Idaho are H. C. Manis, Entomologist; R. S. Snyder, Chemist; Leif Verner, Horticulturist; and C. W. Hungerford, Plant Pathologist. Montana's representatives include J. A. Callenbach and H. B. Mills, Entomologists; H. E. Morris, Botanist; and F. M. Harrington, Horticulturist.

From Oregon are Don C. Mote, Leroy Childs, S. C. Jones, B. G. Thompson, L. G. Gentner, Charles Martin, H. E. Morrison, and R. W. Every, Entomologists; R. H. Robinson, Chemist; C. E. Owens, S. M. Zeller and A. W. Evans, Plant Pathologists.

By far the largest group comes from Washington State. They are: R. L. Webster, E. P. Breakey, W. J. O'Neill, P. M. Eide, Loyd L. Stitt, and David H. Brannon, Entomologists; T. A. Merrill, C. L. Vincent, Louis R. Bryant, F. L. Overley, J. C. Snyder, W. A. Luce, and D. F. Allmendinger, Horticulturists; J. L. St. John, Kermit Groves and Kenneth Walker, Chemists; Geo. Fischer, E. C. Blodgett, D. J. Crowley, C. J. Gould, Folke Johnson and A. M. Bullock, Plant Pathologists.

Representatives from the U. S. Department of Agriculture include: E. J. Newcomer, M. A. Yothers, F. P. Dean, F. W. Carlson, S. M. Dohanian, L. G. Davis and K. A. Haines, Entomologists; W. E. Westlake, Chemist; Edwin Smith and L. P. Batjer, Horticulturists; and J. R. Kienholz, E. L. Reeves, J. D. Menzies and A. H. Thompson, Plant Pathologist.★★

Western Spray Project membership comes from various localities, representing a number of states and the U. S. D. A. as well as Canadian Department of Agriculture. Recommendations based on findings in 1946.

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The Listening Post

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey. The following summary of their most recent reports was prepared especially for this magazine.

By Paul R. Miller

Tomato Blight Warning Service

THE Plant Disease Survey and its collaborators have set up a warning service for 1947 on the spread of tomato late blight. It is hoped that by this means tomato growers will be assisted in preventing such late blight damage as swept through tomato fields and gardens in many of the States East of the Mississippi River in 1946. Last year for the first time commercial tomato fields in the East were seriously affected by late blight, with estimated losses of as much as 50 percent of the crop in some states. If, as was the case then, cool rainy weather obtains, plant disease specialists of the U. S. Department of Agriculture fear this tomato late blight fungus, (which is the same fungus that causes the late blight and rot of potatoes) may again pose serious problems for tomato growers. The fungus lives over winter in potato tubers, on tomato plants in greenhouses in the north, and on tomato plants in the extreme south. Spores of the fungus from these sources are carried by wind and rain to tomato fields and gardens. Late blight spreads rapidly in cool, wet weather but is not likely to reach serious proportions in hot, dry seasons. To enable State pathologists to make the best and most timely recommendations on fungicide spraying and other control measures, a key pathologist in each state will gather information on the earliest occurrences and progress of late blight on tomatoes and potatoes. He will forward that information immediately to the Plant Disease Survey. The Survey will in turn summarize the state reports and distribute the news promptly to all the cooperating states. Members of the Agricultural Insecticide and Fungicide Association will receive copies of these reports.

Last fall about twenty-five agricultural scientists met at the Edisto Experiment Station, Blackville, South Carolina, to discuss informally the problem created for Southern sweetpotato-growing areas by the recently found internal cork disease. All the information as yet available in regard to the disease was reviewed.

Dr. C. J. Nusbaum, who first discovered the disease in South Carolina sweetpotatoes in 1944 and has since done practically all the experimental work on it, set forth briefly the results of his research. The limited information available regarding the occurrence of the disease in other states was presented by representatives of those states.

Sweetpotato roots showing typical dark brown to black, hard, corky spots or irregular areas in the flesh were examined in the laboratory. Symptoms on growing vines were observed in the field plots. The light green spotting or blotching of the foliage, apparently associated with the disease, may be followed by the development of rings of reddish or purplish anthocyanin pigmentation around these spots and by final feathering out and disappearance of distinguishable symptoms.

The main facts brought out included the following: Rather wide surveys in South Carolina had as yet disclosed no section completely free from foliage symptoms and no seed-stocks of sweetpotatoes which can be considered free. The disease was known to extend through North

(*Turn to Page 53*)

Insect Pest Surveys Aid in Controlling Outbreaks

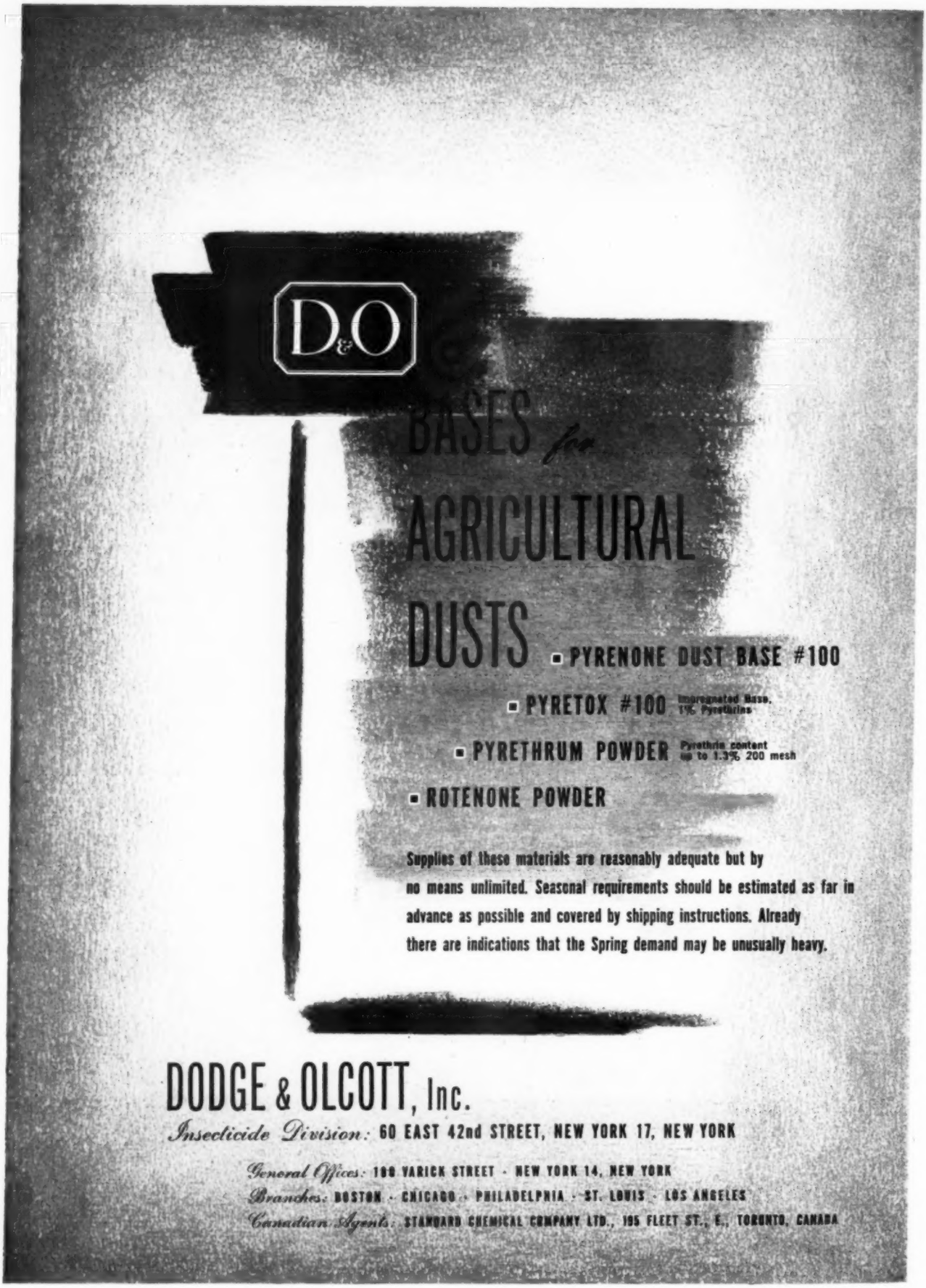
This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

CABBAGE caterpillar infestations continued light to moderate in intensity on cabbage, collards, and cauliflower during the last half of January in parts of South Carolina, Georgia, Florida, and Alabama. In early February these pests were at low ebb in all the territory reporting.

The vegetable weevil continued to cause light to moderate injury, principally to turnips, into early February in parts of North and South Carolina, Georgia, Florida, and Alabama. Late in January it caused serious injury to mustard in parts of Louisiana.

Toward the end of January and in early February the serpentine leaf miner was seriously abundant on tomatoes and potatoes in some sections of Florida. Benzene hexachloride and the chlorinated hydrocarbon "Velsicol 1068" are both reported to have shown promise in the control of this pest there. Light to moderate infestations of the leaf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miner also occurred on beans in Florida and light infestations were present in some cabbage and celery plantings.

The cabbage aphid and turnip aphid continued in light to moderate abundance during the latter part of January and early February on cabbage, collards, broccoli, and turnips in parts of Georgia, Florida, Alabama, Louisiana and southern California.

Moderate infestations of the pea aphid were reported on Austrian winter peas and English peas in Louisiana toward the end of January and light infestations on English peas occurred in southern sections of Georgia into early February.

The screwworm was found in Georgia early in February, prior to the cold wave, as much as one hundred miles north of the Florida-Georgia state line. This is the farthest north this livestock pest has ever been recorded as overwintering in the Southeast.

Since current reports on insect conditions are at very low ebb at this time of year, it may be of interest to digress somewhat from the usual type of observations presented in this column and discuss a recent example of outstanding results obtained through the cooperative efforts of government agencies, the insecticide industry, and growers in controlling a very serious outbreak of an injurious crop pest.

I refer to the 1946 outbreak of the velvetbean caterpillar, which was one of the most widespread and intense outbreaks on record. However, despite the extent and severity of the occurrence of this destructive pest, losses were much less than experienced in previous outbreaks, chiefly as a result of general availability of adequate supplies of insecticides in many local areas and prompt application of control measures. Reported infestations occurred throughout Louisiana, Mississippi, Alabama, northern Florida, Georgia, South Carolina, North Carolina and southern Virginia. The caterpillars were first reported about the middle of July from the southernmost parts of the affected area and the infestation progressed northward with rapid build-up of populations to destructive abundance. The most severe infestations occurred in Georgia, where an estimated $4,000,000 loss occurred to an $80,000,000 peanut crop, and in Alabama where an estimated $500,000 loss to peanuts and soybeans resulted. Losses to soybeans in South Carolina were estimated at $100,000. While the most extensive acreages injured involved peanuts and soybeans, other crops reported damaged included velvetbeans, kudzu, alfalfa, and crotalaria.

	Cryolite	5% DDT	3% DDT	Calcium arsenate
	Pounds	Pounds	Pounds	Pounds
Alabama	4,000,000	——	250,000	50,000
Louisiana	5,000	6,000	46,000	——
North Carolina	5,000	10,000	——	——
South Carolina	75,000	——	——	——

Continuing an arrangement started in 1943, the U. S. Department of Agriculture through the Bureau of Entomology and Plant Quarantine in cooperation with State agencies, assembled and released timely reports throughout the season on the progress and abundance of infestations and on local availability of insecticides and equipment needed for combatting the pest. Aided by this information, insecticide manufacturers and others concerned were enabled to facilitate better utilization of available materials needed by growers to prevent or reduce crop losses. The industry cooperated to the fullest extent possible in rushing supplies of cryolite and other insecticides to those parts of the infested area where they were most urgently required. Shortage of box cars prevented moving the materials by usual transportation means as rapidly as needed. Trucks were therefore used to supplement rail shipments and in addition, considerable poundage was rushed by air. Nevertheless, the supply of cryolite, the material customarily used against this pest, was not sufficient in some areas where it was urgently needed to meet all demands, particularly in parts of Georgia and Louisiana. As a supplementary measure, extensive use was therefore made of DDT and of calcium arsenate of low soluble arsenic content. Estimates indicate that in Georgia about 2 to 3 times as much of the latter material was used as of cryolite and DDT combined. The estimates shown in the table above, though admittedly very incomplete, will give some indication as to the quantities of various insecticides used against the 1946 outbreak of the velvetbean caterpillar in a few of the affected states:

Dust mixtures containing from 2.5 to 5 percent DDT applied at rates of 12 to 20 pounds per acre gave faster action against the caterpillars than cryolite or calcium arsenate and resulted in generally higher control. While calcium arsenate gave faster action than cryolite, it was generally less effective in total control and caused burning of foliage in some instances.

A few figures are available on crops saved as a result of the combined action by federal and state agencies in furnishing reports on the progress and intensity of infestations, by the insecticide industry in moving available supplies of materials promptly to the areas where they were most urgently needed, and by growers in applying control measures. These include an estimated $10,000,000 saving to the Georgia peanut crop, savings of about $5,000,000 to peanut and soybean crops in Alabama, and of approximately $50,000 to soybeans in South Carolina. With the increase in the effectiveness of measures now available to control the velvetbean caterpillar, and the increased recognition on the part of growers of the need for adopting control practices promptly in order to prevent serious losses, better control of future outbreaks may be expected.★★

Bed Bug
Cimex lectularius
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Comments....

By Dr. Alvin J. Cox

This column by Dr. Cox appears as a regular feature of AGRICULTURAL CHEMICALS. Dr. Cox formerly was successively Physical Chemist, Chief Chemist, Assistant Director, and Director of the Bureau of Science, Government of the Philippines. He was appointed Chief, Bureau of Chemistry, California State Dept. Agriculture in 1932, retiring in 1945.

EDITOR'S NOTE: *Dr. Cox reports here the meeting of the Western Cooperative Fruit Spray Project Conference held at the Imperial Hotel, Portland, Oregon, January 22 and 23, 1947.*

THE 21st Annual meeting of the Western Cooperative Fruit Spray Project Conference, the largest such gathering in the history of the organization, had an attendance of 61 at the closed sessions, and some 230 registered for the open meetings. Subjects discussed at the conference included many of the current insect pests, and methods of controlling them.

Following are some of the recommendations to come out of the meeting. For control of thrips, one pound of actual DDT to 100 gallons of water gave good control. The results were best when both trees and ground were treated, but more information on proper timing is needed. Hexachlorocyclohexane was a little less effective than DDT, but the crops were good under both usages. It was reported that broadleaf maple is a host for pear and prune thrips in Hood River, Oregon.

The lygus bug is one of the worst peach pests in the northwest, being very destructive to the fruit. In some cases, 15 percent of the fruit is damaged. DDT, however, is not considered a logical control because of possible subsequent heavy mite infestation. Green peach aphis was controlled by use of a 2 percent oil spray, and in one test, fall application of DDT was effective in control of this pest. No important infestations of oriental fruit moth have been found in the northwest, but search is being made for possible alternate hosts. Over 500 traps were maintained in Oregon from April to October. Twig borer is an important insect on account of the increased plantings of peaches. It is on the increase in the Willamette Valley. DDT has proved no more effective against this pest than former treatments.

Western Cooperative Spray Project

The project was founded in 1926, originally to harmonize investigations on the use of petroleum oil as an insecticide. The movement has since grown to cover other agricultural insecticide materials. Participtating agencies in the group include experiment stations of California, Idaho, Montana, Oregon, Washington, the Canadian Department of Agriculture, the Colorado Division of Agriculture, and the U.S. Department of Agriculture. Officers are E. J. Newcomer, U.S.D.A., Yakima, Washington, chairman; and F. L. Overley, Tree Fruit Experiment Station, Wenatchee, Washington, secretary.

Climbing cutworms may possibly be controlled by use of DDT around the base of trees. Cutworms in hop yards, where infestations of 50 or more of several species per hill occurred, were controlled by dust containing 6 percent DDT applied to the hills.

Shothole borers were controlled in cherry trees with 2 lbs. of DDT, 50 percent in 100 gallons of water. September spraying may be less encouraging on mites. Green fruit worms when they appeared were controlled by means of lead arsenate.

Cherry fruitfly attacks all varieties of cherries and has been successfully controlled by means of lead arsenate, but spray residue is a problem. Rotenone dust gave good control. Fifty pounds per acre of ¾ percent rotenone dust worked well if applied at the right time in three applications at 7-day intervals. One type of rotenone spray used to control fruitfly resulted in some discoloration of the fruit. "Lethane 384" and rotenone afforded a quick knockdown not achieved by other treatments.

Fungicides

BROWNROT in apricots in California is controlled by spraying with calcium arsenite 3 pounds per 100 gallons water . . . a concentration too toxic for most varieties of fruit trees. All strengths used on peaches in the northwest were injurious. Sodium pentachlorophenate, used to kill potato tops, was successfully used to control brownrot on almonds. A report was made on use of new materials against pear scab. In its control, a shift from sulphur to "Fermate," 1½ pounds per 100 gallons water, was reported to have increased the yield of clean fruit by 30 percent. "Fermate" was said to be compatible with other sprays.

The codling moth problem has now become largely a mite problem. When DDT, at one pound per 100 gallons is used, (and the calyx spray and other customary cover sprays omitted) a reduction to 3 applications per season is achieved. The full answer to the problem of the increased number of mites if DDT is used against codling moth is not yet at hand, especially in European redmite areas. A combination DDT-xanthone

These **FACTS** *about*

Compatibility

are important to every manufacturer and user of dust and spray chemicals

▶ Before combining two or more dust or spray chemicals for application to plants, it is important to know whether the materials can be used together conveniently, safely and effectively. This is possible only if the materials are "compatible"—a term which covers three distinct conditions:

Chemical Compatibility

—This refers to the reaction which may take place when two materials are combined. If they do not react with one another in such a manner that their effectiveness is impaired, they can be considered chemically compatible.

Physical Compatibility

—When physically compatible materials are combined, they form mixtures which can be applied efficiently in all commercial types of applicators. Spray materials should mix readily and give uniform coverage without excess "run-off." Dusts should be free-flowing.

Biological Compatibility

—This is the ability of one material to mix with another without reducing the effectiveness of either and without causing injury to the plant on which the mixture may be applied.

Du Pont Dust and Spray Materials, which would normally be used together, are formulated to be compatible chemically, physically and biologically. A chart on the compatibility of Du Pont dusts and sprays may be obtained by writing to the Du Pont Company, Grasselli Chemicals Dept., Wilmington 98, Delaware.

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spray reduces the mite problem. Use of xanthone greatly accentuates the russet color of Bose pears. The treatment for mites should be started 2 or 3 weeks before they are likely to occur, and continued through period of mite activity. It was reported that ¼ to ½ pound "DN 111" to 100 gallons water, sometimes repeated for control of mites did no injury if the orchards were in good condition and it was applied at temperatures below 95 degrees F. When DDT is used, vigilance must be maintained for new problems may arise involving control of insects now of no economic importance. There is danger of increase of wooly apple aphis, for instance. Wooly apple aphis should be controlled, because in cold areas it is associated with perennial canker disease. It can be controlled by use of nicotine. Hexachlorocyclohexane appeared encouraging only as an aphis control, but might be used against codling moth if DDT were not available.

Use of DDT on apples for control of codling moth and failure to control mites, may cause reduction in size and color not offset by improved worm control. Some growers are fooling themselves by being satisfied with worm control without counting their losses.

Pear psylla in Washington, Idaho and Oregon was discussed at the meeting. Special materials for its control are being used. The U.S.D.A. has this project underway and is attempting to suppress spread of the pest.

Cranberry Pests

Cranberry fireworm is closely related to codling moth in control procedure. DDT spray penetrates the web and kills the webbed insects just as in the open. No dusts are used. It was maintained that fireworm can be eradicated from cranberries. Before DDT spray was employed, as many as 10 pyrethrum or rotenone cover sprays were applied at a cost of $70 or $80 per acre. The residual effect of the spray is important. DDT in solution in petroleum oil gave some blossom injury. A considerable amount of the spraying is done before blossoms appear. Both stationary and portable sprayers are used. Cranberry fruit worm shows up at blossom time. Within a day it bores into the berry and seals off behind itself. DDT is effective but is not used. Dimethoxytrichloroethane (dianisyl trichloroethane) is more effective than pyrethrum or rotenone in its control. The damage all occurs over a 12-day period, and 2 properly timed sprays control the pest. There is no mite problem and such a one is unlikely for these areas bog up in winter.

The open session was a fine example of cooperative thinking between research workers, law administration officers and the industry. There was an open forum presided over by the conference leaders at which time the "Suggestions for the Use of Sprays for Orchard Insects and Diseases in 1947" was read and discussed.*

The meeting was turned over to the industry, with Mr. Ed Littooy presiding. The insecticide supply was discussed. The supply of nicotine is expected to continue as short through 1947 as last year. The lead arsenate supply was reported as tight. In addition, certain mid-west states will double their demand for control of an outbreak of red banded leafroller as the result of the use of DDT. Cryolite, petroleum spray oils, and lime-sulphur solution promise to be ample. Rotenone and pyrethrum, if plentiful, are expected to be high priced. The surge of demand for DDT has surpassed previous production. Foreign demand has made its inroads on this product. The supply can be maintained if the necessary raw materials are available. Certain new materials, such as hexaethyl tetraphosphate, might become scarce if unexpected demand develops. The container shortage affects the entire industry. Empty-container return by farmers will be helpful.

On January 25th a conference was held in Vancouver, Washington, by the Extension Service of the State College of Washington to revise the State recommendations for controlling apple and pear insects.★★

* Copies of this report available from F. L. Overley, Tree Fruit Experiment Station, Wenatchee, Wash.

FERTILIZER FACTORY

(*Continued from Page 25*)

most of these order their fertilizer from the company.

Part of the success of this program is due to close cooperation with the soil testing program of the State Agricultural Experiment station at New Brunswick. "We believe that our firm is the only fertilizer plant in New Jersey giving soil analysis service on such a scale," observes Mr. Gordon.

To supplement its chief function of mixing fertilizer, the company also handles certain farm machinery and other agricultural needs which make it unnecessary for customers to wander afield for supplies. Before the war, when machines were plentiful, Chamberlain and Barclay held an annual "farmers' day," serving lunches of sandwiches, cider, peanuts, etc., and featuring movies and a machinery show. As many as 700 persons have attended a single gathering of this nature . . . each presumably returning to his home with a warm feeling toward the firm. In addition to these activities, the company sells between 300 and 400 carloads of seed potatoes annually. "This," explains Mr. Gordon, "keeps our trucks busy in the fertilizer off-season, and enables us to maintain a crew of workmen the year around." The process has further ramifications, too. The firm buys seed potatoes from its customers who in turn give a portion of the money back for fertilizer.

The Chamberlain and Barclay name has been known to generations of farmers of New Jersey. Likewise, farm families have been known to the firm for generations. The company was established a half-century ago by Albert Chamberlain who originally conducted a hay press business. In 1904 E. S. Barclay, now president, bought an interest in the firm, and from that time on, it has followed the general course of fertilizer mixing as it does today. As indicated before, nearly all the firm's business is done directly with the farmer.★★

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Raw Material Markets . .

ALTHOUGH it is now anticipated that the over-all supply of insecticides will furnish adequate protection for crops during the impending season, some toxicants ordinarily used in large quantities are scarce. This is expected to mean that some materials not always used, but presently in good supply, may have to be substituted for insecticides on the short list. No outstanding change appears in this month's report, as compared to last month's.

The same is basically true in the fertilizer industry which is expanding productive facilities for both raw materials and mixed fertilizers. Although production is reaching new highs, the demand for 1947 crops is so great that some doubt is expressed that there will be enough fertilizer to go around. Important bottlenecks continue to lie in the transportation phase of the business.

Insecticides

SUPPLIES of white arsenic are short. Domestic production must be bolstered by substantial imports to meet the demand, according to the U. S. Department of Commerce. Domestic production is contributing but 60 percent of the requirement. Reflecting shortages and higher prices in the field, prices of calcium arsenate have been raised to 9 cents per pound in carload lots, from 8½c. The price in 1 pound bags is reported to be 14c as compared to the former figure of 10c. Production in November, 1946, latest available figures, was 30 percent below output of the previous month. Of the 1,330,000 pounds produced in November, 882,000 pounds were exported. Most of the tonnage went to Peru.

The price of lead arsenate has been advanced from 17½ cents to 20 cents per pound in carload lots, and 21c to 29½c in smaller quantities. November production was 33 percent below the same month last year, but showed a 26 percent increase over the October, 1946 output. As in other cases, exports were high for any month in 1946. The total for November was 581,000 pounds, mostly for Latin American countries.

Paris green has also seen an increase in prices for carload lots to dealers ... from 26c per pound in December to 31c, and to 34c in twenty-five pound drums. Prices in smaller quantities than carload lots range up to 60c.

Heavy exports of copper sulphate were seen in November ... 10,997,000 pounds. Principal destinations for this material were Panama, Costa Rica and Algeria.

Despite recent speculative buying in Peru following the ending of price ceilings, U. S. firms have been able to obtain considerable quantities of cube root and it is believed there will be no further advance in price. The rotenone situation may therefore be considered good, at least at the present time. November imports were small, but during December and the first three weeks of 1947, arrivals at New York totaled close to 2,000,000 pounds.

"Full indication of adequate supplies for 1947" is the statement concerning pyrethrum in the United States. Although higher in price than some other insecticides, ample stocks will permit its substitution for short materials in case of an emergency. Prices are not expected to increase during the coming season, since the 1947 price is stabilized by the British Government.

DDT remains on the short list, and the potential demand increases.

Fertilizers

A DEFINITE trend is seen toward greater fertilizer consumption in mid-western states where rich soil had heretofore made unnecessary the addition of quantities of fertilizer material. The report of 194,714 tons of fertilizer being sold in 5 midwestern states is indicative of this trend. This tonnage was the second highest monthly sale ever recorded ... the previous high being January, 1946. Fertilizer tag sales for 1946 calendar year were 18 per cent over those of the previous year.

Supplies of fertilizer materials are being affected by a number of factors. Exports are larger than in previous years, much of the material going to occupied countries. Including material borrowed by the army for use in Germany and Japan, the total is considerably greater than last year's. A shortage of pressure tank cars is threatening to interrupt both the commercial and army fertilizer programs.

Output of by-product ammonium sulfate in November declined some 11 percent from the previous month, but the production of synthetic ammonium sulfate was at a high level in November. Sodium nitrate has fallen short of expectations, and in turn, a shortage of soda ash has retarded output of the synthetic product. Imports of Chilean nitrate have been delayed by strikes in both the U. S. and in South American ports.

Superphosphate output is running ahead of last year, but it is reported that there is difficulty in securing adequate supplies of phosphate rock and sulphuric acid. Facilities for output thus far exceed the raw material supply. Phosphate rock suppliers are attempting to expand their output to keep up with heavy demand. Lack of equipment and shortage of transportation are serious factors in the process. Possibilities are seen that world supplies of phosphate rock during the current fertilizer year may exceed the 13,687,000 tons under allocation by the International Emergency Food Council. If additional quantities are made available, the Council has indicated they will not be allocated.

A smaller supply of potash during the April-May period, is in prospect. The total may be 25 per cent less than the corresponding period last year, or 118,949 tons for all purposes. Potash production has been running behind because of strikes and lack of box cars. Deliveries contracted for period 8 (February-March) may run into period 9.★★

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Surveys - - -

THE AIF Association has pointed out to Secretary of Agriculture Clinton P. Anderson the importance of pest-control surveys, as a field for agricultural research projects to be organized under the Hope-Flannagan Research and Marketing Act.

Particular attention was called to the need for information on such questions as these:

What insects, fungi, weeds and other pests, not now controlled, are causing serious economic losses?
What crops are not being adequately protected?
What weeds need to be eradicated?
What acreage is involved, and where?
What are the potential fields for defoliants and soil fumigants?
What will protection cost, compared with values of increased yield or improved quality resulting from protection?

The questions are "suggestive rather than complete," the Association emphasized. "Yet they are sufficient to indicate the importance of enlarging and expanding survey work of the Department of Agriculture and of the appropriate State agencies."

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Technical Briefs

New Ant Control Method

The chlorinated hydrocarbon insect toxicant $C_{10}H_6Cl_8$, has been found effective against the red harvester ant, in addition to its being toxic against boll weevil, grasshoppers, Colorado potato beetle, horn worms, corn ear worm stable fly, and others. Experiments were recently made at the Oklahoma Agricultural Station wherein 100 c.c. of a 3.0 percent vol/vol concentration of the material gave satisfactory control, causing large numbers of ants to die outside the nest. An area within an 8 foot radius around the nests became littered with bodies of hundreds of ants, the report states. This toxicant known commercially as "Octa-Klor," is manufactured by Julius Hyman & Co., Denver, Colorado.

•

Location vs Fertilizer

Experiments recently completed by five southern Agricultural experiment stations have revealed that calcium, phosphorus and iron content of cowpeas were influenced more by location than by fertilizer treatments. The tests were conducted at 13 locations in Georgia, Mississippi, Oklahoma, South Carolina and Virginia. According to these results, environmental conditions had a greater effect on the mineral content of cowpeas than fertilizer treatments.

•

New Insecticide Announced

Announcement of a new insecticide said to be effective against insects not affected by DDT was recently made by Dr. Leo R. Tehon, acting chief of the Illinois Natural History Survey. The new material is tetraethyl pyrophosphate, shortened to "TEP". In laboratory tests, it has been effective against aphids and mites which attack peas, apples, potatoes, peaches and other crops. Against aphids, TEP was found to be ten times as toxic as nicotine alkaloid.

The new toxicant was discovered through an extensive series of studies of phosphorus compounds, by George F. Ludvik. Mr. Ludvik is working in the Natural History Survey laboratories on a Monsanto Chemical Company fellowship under the direction of Dr. George C. Decker, entomologist of the Illinois Agricultural Experiment Station as well as of the Natural History Survey.

According to tests, TEP was found to be approximately three times as toxic to insects as hexaethyl tetraphosphate. An advantage of TEP, according to Dr. Decker, is that it does not leave a poisonous residue. The material apparently decomposes within a few days after application, and food products upon which it is used may not need to be washed before marketing.

Mr. Ludvik served for 40 months in the Army Medical Corps before being employed on the Monsanto research project. He holds a Master's degree from the University of Illinois, where he is continuing his graduate work in entomology.

•

DDT on Pear Pests

In a report on the control of codling moth and pear thrips on pears, and cankerworms and green fruit worm on apricots, A. D. Borden, associate entomologist in the California experiment station writes the following summary of his work: Sprays containing DDT wettable powder were found to be much more effective in controlling codling moth on Bartlett and Hardy pears than was the regular standard lead arsenate program. In one Bartlett pear orchard, a standard lead arsenate calyx spray, followed by three DDT cover sprays, and a program involving DDT in the calyx spray, followed by three cover sprays, both resulted in excellent control. In the calyx and first cover spray, 1 pound of actual DDT was used per 100 gallons, while in the last two cover sprays the amount was reduced to ½ pound. In another orchard planted to Bartlett and Hardy pears, excellent control was obtained where standard lead arsenate was used in the calyx and the first cover sprays, followed by DDT used at the rate of 1 pound of actual material per 100 gallons in the last two cover sprays. In this orchard, where the trees were treated with DDT, a marked increase occurred in the almond mite and Baker mealybug population.

Because of late emergence, inconclusive results for the control of adult pear thrips were obtained with DDT sprays and dusts applied to pear trees during the swollen bud stage.

Good control of pear thrips was obtained with DDT sprays applied during the cluster stage of bloom on Bartlett pears.

A spray containing ½ pound of actual DDT per 100 gallons of water, or a 5 per cent DDT dust, was very effective in controlling the larvae of cankerworms and green fruit-worm on apricot.

•

DDT Residue Studied

DDT sprays and dusts leave varying amounts of residue on fruits and vegetables, which do not bear any direct relationship to the number of applications. The amount of residual DDT was found not to decrease proportionately with the length of time elapsing between the last application and harvest. It is concluded that analysis for the amount of DDT in a food is the only safe guide for determining whether it is fit for human consumption. Products tested included blueberries, grapes, peaches, apples, string beans, cabbage, celery, and turnip tops. G. D. Manalo, R. Hutson, and E. J. Benne. *Canning Trade* 68, No. 49, 9, 22 (1946).

•

Tomato Plant Experiments

Experiments to determine if imported tomato plants from South America will withstand certain North American diseases, are being carried on by the Bradenton (Fla.) Vegetable Crops Laboratory. The imported plants are being crossbred with home-grown plants in an attempt to obtain a better producing hybrid.

DUST DRIFT CONTROL

(*Continued from Page 23*)

Drift was eliminated and good control resulted where this mixture was applied with a three-row compressed air atomizing power sprayer. Where it was applied by airplane, no serious drift occurred, but the lack of precision shutoff valves at the nozzles made it impossible to confine the application to the field being treated. Further, the atomizing device was not adequate in that it could not be regulated accurately as to rate of delivery or to the most desirable particle size. Many of the particles were too large, and where the larger particles settled on very young fruits, some injury resulted. This did not appear to be of a serious nature and apparently had no adverse effect upon the yield.

An experiment to test the effectiveness of the calcium arsenate-oil-water suspension when applied by airplane was conducted near the town of Yolo in Yolo County. Attempts were made to apply the material at the rate of 5¼, 7½ and 10 gallons per acre, or at the equivalent rate of 15, 21 and 27 pounds of commercial calcium arsenate per acre. The treatments were not replicated, and two applications were made; the first on August 7 and the second on August 28. Prior to these treatments the entire field was dusted on July 20 with a mixture containing 30 per cent commercial calcium arsenate and 70 per cent dusting sulfur. This early treatment was directed against the tomato mite, and the few hornworms that may have been present at that time. A check was left in order to determine the efficiency of the calcium arsenate-oil-water suspension treatments. Further, the remainder of the field not used in the experiment received the regular commercial calcium arsenate dusting program. Prior to the August 7 treatment, the field was surveyed to determine the degree and uniformity of the infestation. An average of 3 per cent of the small developing tomatoes were found infested. The infestation was not uniform throughout the field, but was heaviest on the side that was to receive the heaviest dosage and lightest on the side that was to receive the lowest dosage. The relation of the treatments to one another was as follows:

1. Calcium arsenate-oil-water suspension ..... 10 gallons
2. Check
3. Calcium arsenate-oil-water suspension ..... 7½ gallons
4. Calcium arsenate-oil-water suspension ..... 7¼ gallons
5. Regular calcium arsenate program

The field was picked three times, and prior to each of these, the degree of infestation for the different treatments was determined. (Summary of this information in Table 1.) Despite the fact that airplane application of the calcium-oil-water suspension was not all that was desired, the control obtained was fair. This method of application shows promise, and improvements are being developed which should aid in securing a practical means of application and better control.

In order to determine the effectiveness of some of the newer insecticides and several calcium arsenate mixtures against caterpillars attacking tomato, a series of experimental

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plots were laid out in a field near Woodland. The plots averaged approximately 0.85 of an acre, and each treatment was replicated four times in a randomized experiment. The experiments were conducted on the Pearson variety of tomato and the following treatments were investigated.

1. Check
2. 3 per cent DDT dust
3. 5 per cent DDT dust
4. 5 per cent DDD dust
5. Commercial calcium arsenate dust
6. Commercial calcium arsenate plus 2 percent oil dust
7. Commercial calcium arsenate-oil-water suspension contentrated spray.

Two applications were made of the above treatments, the first on August 1 and the second on August 23. These were the only treatments given, except that on July 13 the entire field was dusted with a mixture that contained 75 per cent commercial calcium arsenate and 25 per cent dusting sulfur at the rate of 12 pounds per acre.[4] This application was directed against the tomato mite and hornworms, a few of the latter which were just beginning to appear.

The experimental plots were picked three times and a fourth would have been obtained had it not been for a killing frost which occurred on October 28. Prior to each picking, the degree of infestation was determined. This was done by picking and examining 200 ripe fruits from each plot. Thus for each treatment 800 fruits were examined. Infested fruits were divided into two categories. (1) severely infested which included the tomatoes which were ruined and (2) superficially injured, including infested tomatoes slightly damaged or fruits having injury which could be removed rather easily by trimming. The information on the infestation in the ripe fruit is summarized in Table 3.

All treatments resulted in good control. As is seen from the check, the infestation increased in severity as the season advanced. The DDD and DDT treatments gave slightly better control than did the calcium arsenate treatments. The calcium arsenate-oil-water suspension proved to be at least as effective, if not more so, than was the commercial calcium arsenate treatment. In all cases, the control held up remarkably well despite the fact that the last treatment was applied August 23. However with the exception of the DDD treatment, the October 28 survey showed an increase in the amount of infested fruit over the previous survey. This was most marked in the case of the 3 per cent DDT treatment. The two most important caterpillars attacking the tomatoes were the beet armyworm and the tomato fruit worm.

The tomato mite did not prove to be a serious pest in any of the treatments. Rather large populations developed in the calcium arsenate-oil-

[4] This dust was applied by mistake. The composition of the dust should have been 25 per cent commercial calcium arsenate and 75 per cent dusting sulfur.

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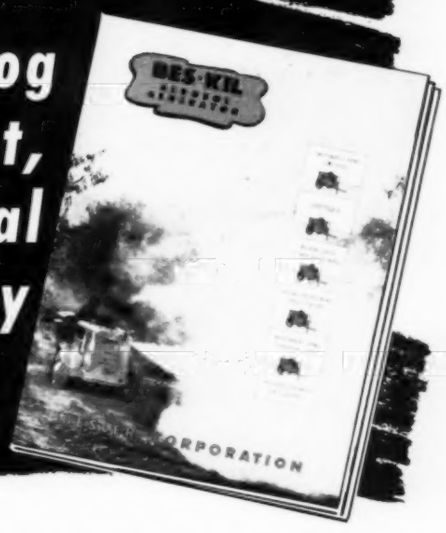

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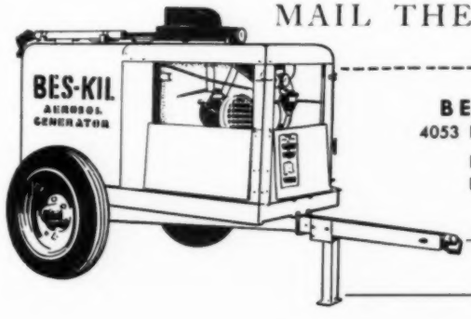

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water suspension treatment, but these occurred so late in the season that little if any damage to the tomato crop could be detected. As might be expected, the July application of approximately 3 pounds of sulfur per acre was not sufficient to insure the most satisfactory control.

The effect of the various treatment in controlling hornworms was observed. The per cent of damaged plants as determined by a survey conducted on September 12 was as follows:

Check	15.50 per cent
5 per cent DDD	0.00 " "
3 per cent DDT	6.50 " "
5 per cent DDT	1.75 " "
Commercial calcium arsenate plus sulfur	0.25 " "
Commercial calcium arsenate plus sulfur plus 2 per cent oil	0.37 " "
Commercial calcium arsenate-oil-water suspension	0.37 " "

The above information was obtained by examining 200 plants from each plot for a total of 800 for each treatment. Observations made throughout the season showed that the tomato hornworm made up most of the hornworm population. From the data at left it is seen that the DDT treatments resulted in the poorest control. The 3 per cent was much less effective than the 5 per cent treatment. Although DDT is probably more effective than calcium arsenate in controlling most caterpillars attacking tomato, it is apparently less efficient than the latter in controlling hornworms. Further, there is published information which states that DDT is not effective against the tobacco hornworm which also occurs on tomato.

Treatments Increase Yield

YIELD records were kept and in all there were three pickings. As already noted, a fourth picking was destroyed by a killing frost on October 28. The harvest information is summarized in Table 4. From the table it is seen that all the treatments far out-yielded the check. This difference was unquestionably due to a serious loss of tomatoes resulting from a heavy caterpillar infestation in the check plots. The actual difference was even greater than that indicated, for fully 1/5 to 1/4 of the fruit in the boxes from the check plots was so severely infested that it had to be discarded. The difference would also have been more pronounced had it been possible to harvest the fourth picking. It is doubtful whether much more than a ton to the acre could have been harvested from the checks as compared to a probable 4 to 5 tons per acre from the treated plots. Further evidence as to the seriousness of the infestation in the check plots could be obtained by pulling back the vines. This would usually reveal a mass of rotting tomatoes. In the treated plots little or no evidence of caterpillar infestation could be detected.

The lowest yield among the treatments was obtained with 5 per cent DDT and the highest with 5 per cent DDD. It is possible that none of the difference between the treatments is significant. However, it is believed that any slight adverse effect by DDT would be re-

(*Turn to Page* 68)

When More Effective Insecticides and Fungicides are produced . . .

LOOK FOR THE *Niagara* TRADE-MARK!

WHEN YOU BUY *Niagara* YOU BUY PROTECTION

SUCCESS in any industrial organization cannot be achieved through charms and magic, or by production of antiquated materials or machines. It requires hard work, continuous research and initiative on the part of the successful industrial manufacturer.

While, in early days, farmers and orchardists employed charms and magic to aid in disposing of destructive insects and diseases, the NIAGARA organization was conducting constant scientific research to bring about greater control of this ever present menace. Remarkable progress has been and continues to be made. Niagara takes pride in the part it has played in this progress. Among the materials developed by Niagara are Kolo products (Bentonite-Sulphur), arsenicals (lead and calcium arsenates), copper products, rotenone combinations, nicotine dusts, organic insecticides, fungicides and herbicides, hormone dusts and sprays, dormant sprays, and the most modern and economical dusting equipment for applying dry insecticides and fungicides. Wherever insecticides and fungicides are used, the name and reputation of the Niagara organization are favorably known and highly respected.

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NIAGARA SPRAYER AND CHEMICAL DIVISION
FOOD MACHINERY CORPORATION
MIDDLEPORT, NEW YORK

Richmond, California • Jacksonville, Florida • Pompano, Florida • New Orleans, Louisiana
Greenville, Mississippi • Harlingen, Texas

Canadian Associate: NIAGARA BRAND SPRAY CO., LTD., Burlington, Ontario

Suppliers' Bulletins

New Powell Catalog

John Powell & Co., Inc., New York, has issued a new catalog on its product "Improved Pyrin #20," a pyrethrum-base insecticide concentrate designed for use in the manufacture of stock sprays and industrial-type insecticides. The catalog features many photographic reproductions, charts, graphs and tables to illustrate uses of the product. Also included are a number of pictures of Powell chemical and biological laboratories.

Included for the first time is a description and structural formula of "Sesamin", the synergist in "Improved Pyrin #20."

•

Hyman Issues Booklet

Julius Hyman & Company, Denver, Colorado, has issued a bulletin containing technical data on its chlorinated hydrocarbon insect toxicant, "Octa-Klor." The booklet presents the physical and chemical properties of the product, its grades, insecticidal properties, and the action of "Octa-Klor" on warm-blooded animals. Its compatibility with other toxicants is described in some detail, as are various suggested formulations for different insecticidal uses. A number of charts are presented showing control of a number of insect pests.

•

Carbide-Carbon Booklet

Carbide and Carbon Chemicals Corp., New York has recently issued a new booklet, "Organic Chlorine Compounds" which presents late data on twelve chlorinated compounds used industrially as solvents, fumigants, and chemical intermediates. The book is one of a series of publications issued by the company on the various groups of aliphatic organic chemicals.

Information is given about properties and uses, specifications, solubilities, comparative stability to reducing and oxidizing agents, and constant boiling mixtures. Charts showing the variation of certain properties with respect to temperature are given, and a comprehensive bibliography is included. Copies are available from the company's offices, 30 East 42nd St., New York 17. The booklet is designated as Form No. 4769.

•

L. L. Chemical Catalog

A new 64-page catalog of chemicals for agriculture and industry has recently been published by the Los Angeles Chemical Company, of 1960 Santa Fe Ave., Los Angeles 21. The booklet not only lists the company's products, but shows as well a number of views inside the plant, and of many of the chemicals in use agriculturally. Products include many insecticides for orchard and field, including DDT, the arsenates, organics, inorganics, rotenones, copper, etc.

•

Besler Produces New Film

A new 16 mm. sound and color film has been produced by Besler Corporation, Emeryville 8, California, showing its "Bes-Kill" fog generating machine in action. The film, which of course requires use of a sound projector, runs for 15 minutes. The company announces that a number of prints are available for distribution or loan for distributors or growers' meetings.

•

Mask Features Wide Vision

Mine Safety Appliances Co., Pittsburgh, has placed on the market its new "Fulface Dust Mask" which features comfort and safety for the wearer. Described as being lightweight and flexible, and built to conform with facial contours, the mask covers the entire face of the wearer. A large single clear plastic lens permits wide-angle vision, and rubber air deflectors direct incoming air over the inside surface of the lens to prevent fogging. Further details are available from the company, Pittsburgh 8, Pa.

Carbide-Carbon Co. Waxes

A series of water-soluble "waxes" for use in the field of plant physiology has been placed on the market by Carbide and Carbon Chemicals Corporation. The company points out that these waxes, unlike self-emulsifying waxes, dissolve in water to form solutions as transparent as water itself. It is reported that entomologists, physiologists, and agronomists find use for these "Carbowax" compounds as vehicles and adjuvants for plant hormones, selective weed killers, insecticides and other materials possessing physiological properties.

•

Publications Listed

A revised list of publications has been issued by the New York State College of Agriculture and the Cornell University Agricultural Experiment Station, Geneva, N.Y. The booklet is designated as "Cornell Extension Bulletin #47." It lists several hundred publications covering many fields of agricultural activity. These include spraying and dusting recommendations for control of insect pests and plant diseases, fertilizer discussions, and bulletins on entomology and phytopathology.

•

Dobbins Catalog Out

A new general catalog of power sprayers, hand sprayers, dusters and hand platers has recently been released by Dobbins Mfg. Co., of Elkhart, Indiana and North St. Paul, Minn. The book contains 48 pages in full color, describing various items in the firm's "Superbilt" line. The copy is designed to aid dealers in making correct recommendations for special requirements, and to inform customers of the rather wide variety of equipment soon available.

•

S.W Co. Markets Duster

Sherwin-Williams Co., Cleveland, announces a new three-foot insecticide gun known as the "Bug-Blaster." The apparatus, shaped like a tube, contains materials toxic to some 27 common plant insects and diseases. A single gunful is claimed to be sufficient for a year's use by the average gardener.

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1. The FAMOUS BLACK LEAF 40—Used as a spray or dust in controlling small insects and plant lice. Also used to control external parasites of cattle, sheep and poultry—and as a drench for sheep.

2. BLACK LEAF 155—for cover sprays for codling moth.

3. BLACK LEAF POWDER AND PELLETS—for controlling the large roundworm in chickens.

4. BLACK LEAF 155 WITH DDT—for control of codling moth and certain other insects.

5. BLACK LEAF 10 DUST BASE—meets the demand for a non-alkaline neutral dust.

6. BLACK LEAF CUNIC DRENCH—for sheep and goats. Formula recommended by U.S. Dept. of Agriculture.

7. BLACK LEAF DRY CONCENTRATE—used either as a spray or base mixture with carrier for dusting.

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TOBACCO BY-PRODUCTS & CHEMICAL CORPORATION, INCORPORATED
LOUISVILLE, KENTUCKY

INDUSTRY NEWS

AIFA in April Meeting

Preparations are being made for the annual spring meeting of the Agricultural Insecticide and Fungicide Association, to be held April 24 and 25 at the Westchester Country Club, Rye, N.Y. This meeting, limited to the association membership, promises thorough discussion of problems facing the industry, and addresses by men prominent in the economic, legislative, and industrial fields.

Although plans are not yet complete, scheduled speakers include O. V. Wells, Chief of the Bureau of Agricultural Economics, U.S.D.A., who will discuss agricultural prices; S. A. Rohwer, of the Bureau of Entomology and Plant Quarantine, U.S.D.A.; Kirk Fox, editor of *Successful Farming* magazine; and Dr. W. J. Hale, of Dow Chemical Company.

Lea S. Hitchner, executive secretary of the AIF Association, New York, stated that interesting reports are expected from various committees of the association. Among these are the technical committee and the legislative committee whose findings are received with interest by the industry each year.

•

Westvaco Advances Three

Westvaco Chlorine Products Corp., New York, has announced the recent advancement of three executives including J. A. Mooney, M. H. Norton and Thomas F. Jackson. Mr. Mooney, general superintendent since 1945, has been made resident manager of the South Charleston plant of Westvaco. He has been with the firm since 1932. Mr. Norton, with the company since 1927, is now general superintendent of the South Charleston plant.

Mr. Jackson has been appointed resident manager of the Carteret, N.J. plant, where he has been acting manager since early in 1946. He has been with Westvaco since 1936, became production superintendent in 1941, and assistant resident manager in 1944.

•

Potash Controls Retained

Government control of agricultural potash appeared likely for continuance early this month when supplies were estimated to be some 25 percent below amounts delivered during the April-May period of 1946. Controls were to remain in force until delivery of potash to fertilizer manufacturers is sufficient to meet allocations for the period from June, 1946, through March, 1947.

Transportation difficulties head the list of difficulties, with a lack of boxcars foremost in this category. For the April-May period, an estimated 118,000 tons of potash were available, and an increase of some 6,000 tons possible if sufficient boxcars could be made available.

•

N. J. Mosquito Group Meets

The annual meeting of the New Jersey Mosquito Extermination Association is planned to be held at Atlantic City, N. J., April 2, 3, and 4, according to Thomas D. Mulhern of New Brunswick, secretary of the group. Headquarters will be at Hotel Haddon Hall. Reservations are being received by the hotel, with the suggestion that all such be made early as possible.

•

Colefax Elected President

Peter Colefax, formerly executive vice-president of American Potash & Chemical Corp., Los Angeles, was elected president of the company at a meeting of the board of directors on February 21. Mr. Colefax, who joined the company 12 years ago, succeeds Frederick Vieweg who recently resigned. The former president will remain on the board of directors and his services will be available to the company in a consultant capacity, according to B. R. Armour, chairman of the board.

Pest Control Course at Pa.

A short course in pest control, the first ever offered in the state, was held at Pennsylvania State College last month, under the direction of Dr. E. H. Dusham, head of the department of entomology, and Dr. E. H. Frear of the department of agricultural and biological chemistry, both of Pennsylvania State College. The group devoted a major portion of the time in identification of insect pests, and in question-and-answer sessions. College laboratory facilities such as microscopes and specimens of various insects were at the disposal of the group during the meeting.

Taking part in the instruction work, in addition to Drs. Dusham and Frear, were Drs. V. R. Haber, E. J. Seiferle, John O. Pepper and Henry Menusan, Jr., all of Pennsylvania. Dr. J. J. Davis of Purdue University, was the speaker at a banquet.

•

Aero-Mist Demonstrated

The new Lawrence Aero-Mist machine was demonstrated publicly for the first time recently at Darien, Connecticut. At the controls was the inventor and designer, Ben Lawrence, who was making delivery of the outfit to W. J. Cotta of Darien, a commercial sprayer. The machines, mounted on a truck and powered by a 30 h.p. water cooled motor, had no difficulty in propelling the mist over the tops of 50 ft. trees despite a heavy wind.

The spray is expelled by a centrifugal fan operating at 3,600 rpm, producing 8,000 cubic feet of air per minute at a velocity of 150 miles per hour. The unit can be detached from the truck on which it is mounted. The spray can be directed at any angle between the horizontal and vertical, by one operator who regulates the flow as well as directing it.

Manufactured by the Lawrence Aero-Mist Sprayer Co., Greenfield, Mass., the apparatus is said to be available to custom sprayers.

Ohio Horticulture Meeting

The Ohio State Horticultural Society held its annual meeting in the Deshler-Wallick hotel, Columbus, February 26, 27 and 28. Subjects for discussion included fruit disease control, orchard insect pests, and a symposium on new insecticide and fungicide application equipment. In the latter category, talks were scheduled to be given by Howard Ingerson of John Bean Mfg. Co., Lansing, Mich.; R. H. Paxton, of F. E. Myers & Bro. Co., Ashland, Ohio; A. L. Burdick of Hardie Mfg. Co., Hudson, Mich.; Fred A. Rueter of Homestead Valve Mfg Co., Coraopolis, Pa; E. J. Nutter, Agr. Aviation Co., Dayton, Ohio, and Frank Irons Sr., Agricultural Engineer, U.S.D.A. Engineering Laboratory, Toledo, Ohio.

Officers of the Ohio Society are L. G. Dean, Geneva, Ohio, president; Ben Davis, Clyde, Ohio, first vice-president; E. C. Cotton Elyria, Ohio, second vice-president; Frank H. Beach, Columbus, secretary, and C. E. Ellenwood, Wooster, treasurer. Program committee included C. E. Dutton Milford Center; Tom Price, Newark; and Frank Farnsworth, Waterville.

•

New Ga. Fill Regulation

New regulations covering the filling of packaged products have recently been announced by the Georgia Commissioner of Agriculture. The regulations deal particularly with the subject of underfilling of packages and their strict enforcement would, it is reported, present serious problems to packagers of argicultural insecticides, fertilizers, etc., which even under the best commercial packaging practice are likely to reach the consumer with more than the 10 per cent underfill fixed as the permissible maximum under the new regulations. It is reported that an informal conference may be held with the Georgia officials shortly in an attempt to iron out the problem.

•

Cochran Joins Tyner-Petrus

Ray N. Cochran, formerly of John Powell & Co., New York, has joined the staff of Tyner-Petrus Co., West Monroe, Louisana and is at present engaged in directing the installation of new insecticide processing and mixing equipment at the company's plant. Mr. Cochran was previously attached to the technical sales staff of the Powell Chicago branch under the direction of D. W. Lynch and traveled chiefly in the South and Southwest.

•

Sheffield New Secretary

W. H. Sheffield, Jr. has been elected secretary of Innis, Speiden & Co., New York, it was announced recently. Mr. Sheffield, assistant treasurer of the company, was also re-elected a director at the same meeting of the board. Other officers of the company remain in their positions. These include W. H. Sheffield, Sr., president and director; E. C. Speiden, vice-president and general manager of Isco Chemicals Division: G. S. Hamilton vice-president and comptroller; C. C. Wickstead vice-president and treasurer. Halsey F. Sheffield and T. G. Flavelle, the latter manager of the Gums and Waxes Division, continue as directors.

You name it, Stauffer has it. A complete line of agricultural chemicals conveniently stocked in plants and warehouses in every agricultural section of the country.

Stauffer manufactures a grade of sulphur for every type of equipment and for every agricultural purpose in which sulphur is used . . . Sublimed Flowers of Sulphur—Wettable and Dusting Sulphurs in various purities and finenesses — Commercial Flour Sulphur — Refined Roll Sulphur — Agricultural Soil Sulphur.

Stauffer also offers a complete line of insecticides . . . DDT, Rotenone, Pyrethrum, Cryolite, etc., blended with inert carriers or combined with Sulphur for either spraying or dusting.

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221 North LaSalle Street, Chicago 1, Illinois 555 South Flower Street, Los Angeles 13, Cal.
Apopka, Fla. North Portland, Oregon Houston 2, Texas

Fellowships by U. S. Rubber

Graduate fellowships in chemistry have been established in ten American universities by the United States Rubber Company, it was announced last month. The institutions accepting the fellowships include the California Institute of Technology, Pasadena, California; Cornell University, Ithaca, New York; Harvard University, Cambridge, Massachusetts; Massachusetts Institute of Technology, Cambridge, Massachusetts; Northwestern University, Evanston, Illinois; University of California, Berkeley; Univ. of Calif., Los Angeles, California; University of Chicago, Chicago, Illinois; University of Minnesota, Minneapolis, Minnesota; University of Wisconsin, Madison, Wisconsin.

Under the arrangement, fellowships will be available for the academic year starting July 1, 1947. The recipient will receive $1,200 per year if single, or $1,800 per year if married. The university will receive $1,000 to cover tuition and other costs. Fellows will be selected in accordance with the established practices of each university, and none will be restricted in his choice of position after the expiration of the fellowship, according to the company.

•

Insecticide Film Shown

Rohm & Haas Company, Philadelphia, has produced a new sound movie film entitled "Our Constant Enemy, the Insect." The half-hour picture, in technicolor, relates the history of insect destruction in industry, in the home, and in agriculture.

Close-up shots of many well-known agricultural insect pests are shown, including the Colorado Potato Beetle, the corn ear-worm, and various other chewing and sucking varieties of insects. The action of contact and stomach insecticides is shown, as well as the various methods used in testing toxic materials. Steps in the manufacture of insecticides are described in the film, and many pictures of application in the field are shown.

The film is to be available for private showing, according to Rohm and Haas Company. Information concerning this can be obtained from the company, Washington Square, Philadelphia 5.

•

Enforcement Club Formed

Dr. J. L. St. John, state chemist in charge of the Washington State Division of Chemistry, and Allen B. Lemmon, chief of the California Bureau of Chemistry, were chosen acting president and secretary, respectively, of the new Association of American Economic Poisons Control Officials at a January meeting in Portland, Oregon. West coast administrators are seeking to establish a nation-wide enforcement body to promote uniform and effective legislation, definitions, rules and enforcement of laws relating to sale and distribution of insecticides, fungicides and other economic poisons.

Officials of other states are invited to join the body in the hope that a general meeting may be called next fall. At that time it is expected that officers may be elected, and a constitution adopted.

What Brand of DDT

is Upholding the Reputation of Your Products?

If you are using Geigy GESAROL* and NEOCID* DDT compositions you can be sure that the DDT content of your finished preparations is the finest obtainable.

Further, when you deal with Geigy you get "facts from the source" —*proven* facts—direct from the *"Originators of DDT Insecticides."*

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Many Chemical Exhibitors at Turf Show

THE 18th Annual National Turf Conference and show was held February 11-14 at the New Yorker Hotel, New York. A number of papers were presented, many covering subjects of agricultural application. Among these were presentations by Dr. Clyde Hamilton of the New Jersey Experiment Station, New Brunswick, N.J., who spoke on "Insect Control on Lawns;" and Dr. Paul C. Marth of the hormone project, U. S. Golf Association, Greens Section, Beltsville, Md., who discussed "The Present Status of 2, 4-D." Marshall E. Farnham of the Philadelphia Country Club spoke on "Fungicide Trials in the Philadelphia District."

Among the scores of exhibitors displaying merchandise and equipment at the show, were manufacturers and distributors of fertilizers, weed killers, insecticides, fungicides, and spraying equipment. Among such companies were the American Agricultural Chemical Co., New York, fertilizers: John Bean Co., Lansing, Mich., sprayer equipment; Brulin & Co., Inc., Indianapolis, Ind., weed killers; Chipman Chemical Co., Bound Brook, N.J., weed killers and insecticides; C. B. Dolge Co., Westport, Conn., weed killers; Dow Chemical Co., Midland, Mich., weed killers; E. I. duPont de Nemours & Co., Inc., Wilmington, weed killers and fungicides; Friend Mfg. Co., Gasport, N.Y., sprayer equipment; Golf Lawn and Supply Corp., White Plains, N.Y., equipment & supplies; Mallinckrodt Chemical Works, St. Louis, mercurial fungicides; Metalsalts Corp., Paterson, N.J., mercurial fungicides; Niagara Sprayer & Chemical Division, Food Machinery Corp., Middleport, N.Y., insecticides and fungicides; Charles Pfizer & Co., New York, mercurial fungicides; O. M. Scott & Sons Co., Marysville, Ohio, seeds, fertilizers, weed killers.

Sewerage Commission of Milwaukee had a display of fertilizer materials; Sherwin-Williams Co., Cleveland, Ohio, weed killers; Swift & Company Plant Food Division, Chicago, fertilizers; and numerous other firms had on display other appropriate mechanical items such as mowers, grass sweepers, sprinklers, etc.

Educational exhibits included those of the U. S. Golf Association Greens Section; the New York-Connecticut Turf Improvement Association, the New Jersey Experiment Station and New Jersey Greenkeeping Superintendents' Association, and the War Department Office Chief of Engineers.

The meeting attracted a large number of spectators, and managers of exhibition booths reported lively interest in goods and services offered by the firms represented. The show is held annually by the group.

SING A SONG OF SELLING
OH! WHAT A TUNE!
LOWELL
YOUR PRODUCT
inman
Your good chemical product sells well enough by itself. And so do Lowell Sprayers and Dusters. But why not team them up in a fast-selling duo?
Your product is most effective when it is applied properly. To get the best application a good sprayer or duster is a must. When your product is applied right, it produces the best results and you get repeat sales. So we say "let's team up!"
Don't be "insecticide-wise and sprayer-foolish." Let Lowell Sprayers and Dusters help build business for you. Write us!
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WORLD'S LARGEST MANUFACTURER OF SPRAYERS AND DUSTERS EXCLUSIVELY

$37,500 Grant to Vermont

The department of agricultural biochemistry of the Vermont Agricultural Experiment Station was named recipient of a $37,500 research grant from the Herman Frosch Foundation, it was announced recently by J. E. Carrigan, experiment station director. The grant is of five years' duration, and is to be paid at the rate of $7,500 annually. Although the plan is scheduled for five years, it may be continued if results are considered to be satisfactory.

In explaining the use of these funds, Dr. John E. Little, head of the agricultural biochemistry department says that the department is working "on the assumption that varieties of plants resistant to certain organisms causing plant diseases owe their resistance to antibiotic substances in the juices of these plants. Our purpose is to find, purify, identify, test and perhaps synthesize these compounds hoping that they will turn out to be effective materials in the treatment of plant and farm animal diseases."

•

Lawn Supply Co. Expands

The Golf and Lawn Supply Corporation of White Plains, N.Y., which acts as distributor for seeds and agricultural chemicals for golf courses, parks and cemeteries, has recently moved into its new retail store in White Plains. The building is located on a plot containing 2½ acres of land. In addition to the new building, the company also operates its own warehouse, giving a total floor space of nearly 12,000 square feet.

•

Canadian Association Meets

The Chemical Market Research Association met at the Mount Royal Hotel, Montreal, Que., early in February to discuss the "long view on the chemical trade between the U.S. and Canada." Scheduled speakers included Wm. H. Losee, director of the division of census of industry and merchandising, Ottawa; Prof. H. R. Kemp, director of commercial relations, dept. of trade and commerce, Ottawa; R. N. McCormick, Canadian Manufacturers' Association, Toronto; and the Hon. C. D. Howe, Minister of Reconstruction in the Canadian Government. Chairmen of various sessions included R. B. Wittenberg, president of the Association, and Victor G. Bartram, president of Shawinigan Chemicals, Ltd., Montreal.

•

Plant Food Council to Meet

The second annual convention of the American Plant Food Council will be held June 13, 14 and 15 at Hot Springs, Virginia, according to Clifton A. Woodrum, president of the Council. Final plans for the meeting are not yet complete, but are expected to be ready for announcement in the near future.

•

Dr. A. R. Mann Dies

Dr. Albert R. Mann, from 1924 to 1931 dean of the New York State Agricultural Experiment station at Geneva, and the author of numerous articles in agricultural journals and other scientific publications, died suddenly on February 21 a few hours after his return to the U.S. from a trip to Europe.

Innis, Speiden & Co. Form 25-Year Club

Innis, Speiden & Co., New York, have formed a "Quarter Century Club" composed of organization members who have served the firm 25 years or more. Charter members of the club are pictured above watching W. H. Sheffield, president of the company, as he signs papers bringing the club into being.

Seated from left to right are: Thomas G. Flavelle, Manager Gum & Wax Division & Director; William H. Sheffield, President; Charles C. Wickstead, Vice President & Treasurer. Standing from left to right are: P. L. Frost, Manager of Sales; John Breckwoldt, Accountant; George Sonnek, Credit Division; Rose G. Oliver, Insecticide Division; Herbert S. Cottrell, Manager Chemical Department; Frank Grilli, Chemical Department; Herman Price, Manager Traffic Department; Paul W. Hiller, Sales Department; Edward Schaaf, Sales Department.

Other members of the Quarter-Century Club not in the photo, include: Henrietta P. Runyon, Chicago Branch; James O'Connell, Jr., Boston Branch Manager; A. F. Cuneen, Boston Branch; William J. Thorn, Philadelphia Branch Manager; Edward D. Baumeister, Supt. Jersey City Factory; R. P. Heron, Philadelphia Branch.

Zinc Production to Start

The newly-formed Zinc Chemical Co., Inc., New York, announces that it expects to start production of zinc sulfate in March. Formation of the firm was announced a month ago. Phelps-Dodge Corporation, 40 Wall St., New York 5, will act as selling agents for the new company.

•

Miner Lab. Expands

Miner Laboratories, Chicago, has announced the creation of a new entomological division to add to its other industrial chemical departments. The new division is in charge of Dr. Barbara Miner Parker, a graduate of Ohio State University. Dr. Miner worked for a year as a research assistant at the New Hampshire State Experiment Station, and later in the State of California entomological laboratories at Chico, California. For the past few years she has been a staff member of Miner Laboratories in Chicago.

Insect pests under control ...BY TIFA

...Death-Dealing Fog For Insects

TIFA is the scientifically proven insecticidal fog applicator for *dependable* use wherever insect pest control is required . . . in houses, barns, buildings, corrals, pens . . . on livestock and crops . . . in forests, orchards and on open ranges.

TIFA efficiently discharges the newly developed as well as the older insecticides, fungicides, repellents or hormones of the selected particle size in a true fog. This fog *spreads rapidly*, over wide areas, *clings* to everything in its path and *permeates* the smallest crevices.

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Potomac Division Plant Pathologists Meet

THE fourth annual meeting of the Potomac Division of the American Phytopathological Society was held February 19 and 20 at the U.S. Department of Agriculture Plant Industry Station, Beltsville, Md. Dr. V. F. Tapke of the Cereal Division, Bureau of Plant Industry, was elected president, succeeding Dr. E. E. Clayton of the Division of Tobacco, Bureau of Plant Industry. Dr. W. F. Jeffers of the University of Maryland was named vice-president, succeeding Dr. Tapke. New Secretary-treasurer is Dr. W. W. Diehl of the Micology Division of the Plant Disease Survey, succeeding Dr. Jeffers. Dr. Clayton, former president, replaces Dr. R. J. Haskell of the U.S. Extension Service, as counselor.

A number of fungicides were discussed in papers presented at the two-day sessions, as were soil fumigants and various materials for seed inoculation. Dr. J. W. Heuberger of the University of Delaware discussed "Specificity" of metallic dithiocarbamates in the control of vegetable diseases, and V. F. Tapke told of new methods of artificial seed inoculation for testing the resistance of barley against stripe disease. Dr. G. F. Miles of du Pont Semesan Division demonstrated the Slurry method of seed treatment, and Dr. Floyd F. Smith of the U.S.D.A. Plant Industry Station demonstrated the use of insecticidal aerosols in a greenhouse for control of aphids.

A dinner in the station cafeteria was followed by a series of movie films on seed treatment, produced by E. I. duPont de Nemours & Co., and others on weed killers and insecticides by the Sherwin-Williams Co. Dr. R. H. Larson of the University of Wisconsin showed about 100 colored still shots of his recent tour of England, picturing many of the plant disease problems and other agricultural difficulties faced by the British. These pictures showed a number of prominent plant pathologists of the British Isles, and the laboratories where they operate. Dr. Larson remarked that English methods in many respects are at least fifty years behind those used in the United States.

The meetings, held in the administration building auditorium, were well attended at all sessions. In charge of the program was a committee composed of Dr. J. B. Demares, chairman; Dr. W. D. McClellan and Dr. C. E. Cox.

•

25th Anniversary Dinner

The 25th anniversary of the founding of Faesy & Besthoff, Inc., New York, chemical manufacturers, was observed at a dinner party at New York's Hotel Commodore, February 4. Thirty employees of the company were present to offer congratulations to the founders, Robert Faesy and Silas Besthoff who established the business in 1922. In addition to the honors paid the owners and their wives, recognition was also given Harry C. Landwehr, accountant for the firm since its beginning.

SPEED SPRAYING

(*Continued from Page 27*)

proved sprayer for spraying the huge citrus trees of the Mills Orchid Company, Hamilton City, California, showed remarkable effectiveness and demonstrated conclusively the direct relation between air volume velocity, density and size of the tree to be sprayed.

The principle of using driven air as a carrier for spray materials has been proved far superior to conventional high-pressure pump methods.

At this time when costs of both labor and production are high, and high efficiency in plant disease and pest control extremely necessary, the worth of these machines will be clearly demonstrated during the next year or two.★★

Shell Chemical Names Sales Representatives

A. L. Taylor P. J. Westgate E. E. Heuermann

Announcements of three appointments were recently made by Shell Chemical Corporation, San Francisco. Eric E. Heuermann, A. L. Taylor, and Dr. P. J. Westgate are the appointees, all of whom will represent Shell in various sales territories.

Mr. Heuermann, formerly manager of a large California ranch, has been appointed agricultural representative for the eastern division of Shell Corp. He has lately been engaged in research and sales development work with soil fumigants and nitrogen fertilizers.

Dr. Westgate will act as Shell Corp. sales service representative in the Florida area. He is a graduate of the University of Hawaii, and was formerly a horticulturalist at the University of Florida Sub Tropical experiment station. He holds degrees from Cornell University and the University of Wisconsin in addition to his work in Hawaii.

Mr. Taylor will represent the company in the states of N. Carolina, S. Carolina, Alabama and Georgia. He has spent a number of years conducting experiments on the control of nematodes in the south, and is a graduate of George Washington University. He did post graduate work in parasitology at Johns Hopkins University.

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"Senior" students at work at Farmingdale, L.I., Institute of Agriculture. Left to right: Bert Holm, 21, specializing in agricultural research; C. R. Brown, 22, interested in entomology; Oman J. Carrington, 34, particularly interested in agricultural sales and service. Girls are Miss Miriam Eliasberg, 21, specializing in laboratory and field research; Miss T. Sylvia Berenstein, 20, also interested in research; and Miss Eva Cohn, 21, (foreground) interested in soils and agricultural pest control. These students were to be graduated from the new Research Technology curriculum of the school.

THE first class to graduate from the New York State Institute of Agriculture at Farmingdale, Long Island, was scheduled to receive diplomas at the end of this month. The three men and three women, have received thorough instruction in plant pathology and entomology, and, according to Louis L. Pyenson, instructor, the six will be well fitted for careers in the agricultural chemical field.

Based upon the success of the school thus far, the Farmingdale institution plans to add instruction in handling data, including the slide rule, graphs, histograms, logarithmic probability, calculating standard errors, and significance.

The present course was worked out through the cooperation of the technical committee of the Agricultural Insecticide and Fungicide Association, and included numerous talks by industry research men, and study visits to manufacturing plants. Emphasis is placed on practical application of principles learned in class.

LISTENING POST

(*Continued from Page* 41)

Carolina from north to south. The disease is rather widespread in Georgia but apparently confined to limited sections with districts free from the disease in between. It has not been found in Tennessee except at one limited location where all affected stocks were destroyed. The situation in Alabama, Florida, Louisiana, Arkansas and states father west as well as in Virginia was unknown. No evidence of the disease in commercial fields in Maryland has been seen by the representative from that state.

The disease does not usually cause any necrosis of foliage and no evident reduction in yield but the dark, hard, corky areas found in the flesh of affected sweetpotatoes. Although not affecting the flavor and consistency of surrounding tissue, such a condition is objectionable in itself. No large percentage of disease has been found so far in the general run of commercial crops from affected fields.

The disease has not been transmitted by juice from infected plants through rubbing healthy foliage nor by using needle punctures. Transmission by core grafts has been successful, leaving little doubt as to the virus nature of the pathogen. All attempts to isolate a fungus or facterial pathogen have failed. The host range is unknown. No suspicious symptoms have been observed on the related wild morning glory, annual or perennial. The vector is as yet unknown, but circumstantial evidence points to probable insect transmission. Attempts to control this disease by chemical means are not feasible at present; however it should be of interest to watch for possible developments along these lines.★★

GUEST EDITORIAL

(*Continued from Page* 16)

The greatest feed grain crop of America is corn, the welfare of which is safeguarded in every way known to science. Initial tests, results of which have been only recently announced, indicate that DDT may be a boon to the entire corn belt in helping erase the threat of the European corn borer.

Possibilities of genuine service to mankind from the new chemical weed killers are about as great as those of DDT. The annual national loss from weeds is said to be 3 to 5 billion dollars, more than the combined national loss from insects and diseases of both plants and animals. This loss from weeds is experienced each year despite the trusty hoe, the cultivator, and as a matter of fact, in spite of the newest streamlined equipment for tilling crops. There is still much to learn about selective weed killers. Probably we have merely "scratched the surface" in this field of endeavor. But enough has been seen and experienced to indicate that, sooner or later, chemical weed killers will revolutionize many phases of weed control and thus reduce the tremendous toll of moisture and soil fertility annually taken by weeds.

New developments, such as these, are not only important, but spectacular as well. The publicity which has accompanied their introduction to the public has directed a great deal of attention their way.

But not to be overlooked are some of the "old-faithful" agricultural chemicals that have long since contributed greatly to our national wealth. Truly representative of this group, no doubt, are the commercial fertilizers. Agricultural America has learned of the power of fertilizer to keep soils "young" and of its ability to breathe life into worn, exhausted soils. Use of commercial fertilizers has increased, year after year, giving birth to a gigantic industry in the preparation and distribution of these vital materials. There is virtually no virgin soil that can be called upon to help feed an ever-increasing population. But agricultural fertilizers offer a solution to the problem of increasing the nation's food supply. With the nation now awake to the need of preserving the land and the establishment of a systematic, country-wide soil conservation program, it can be expected that the demand for commercial fertilizers will be much greater than ever before in our history.

It has been said that proper and adequate use of fertilizers in the United States would increase national production in an amount equal to bringing under cultivation an additional 30 million acres of land. Our soils continue to grow older, and at the same time nutritional demands upon them are intensified. Fertilization is thus more and more coming to be considered a routine part of the accepted production process.

America looks forward to new progress and greater accomplishments through the continued use of modern agricultural chemicals. We know that more new developments will appear in this field. They will continue to appear through the years, and old methods will be forced to give way to the new.

As in the past, each development and its industry must be protected by sound state and national laws. Experience has proven that the right kind of laws and controls protect not only the user of agricultural chemicals, but also dependable, careful manufacturers, processors and distributors. Lack of control can seriously injure all concerned. Both user and the industry are protected from unscrupulous operators where the statutes require proper labeling and instructions.

Adequate control for fairness and stability in the agricultural chemicals industry is made more difficult by the rapidity of new developments and new products. Results of such regulations probably are best illustrated by smooth-working, uniform fertilizer laws in various states throughout the nation. Low quality materials and questionable practices are virtually unknown to the industry at this time. The buyer purchases with confidence, while processors and distributors take pride in the fact that their industry is recognized by the general public as being sound, reliable and essential. Such are the conditions under which the industry will prosper and under which agricultural chemicals of all kinds will continue to make their greatest contributions to civilization.

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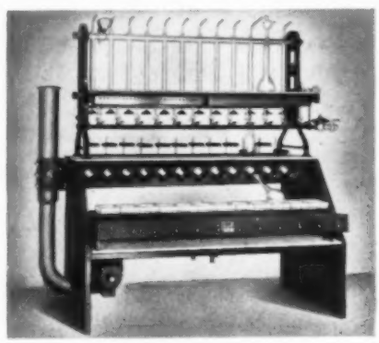

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Industry Patents

The following patents have recently been issued by the U.S. Patent Office on products and devices in the agricultural chemical field. Copies of the patents may be obtained at 25c each by addressing the U.S. Patent Office, Washington 25, D.C.

2,413,627. **Parasiticidal Compositions.** Patent granted December 31, 1946, to William F. Hester, Drexel Hill, and W. E. Craig, Philadelphia, assignors to Rohm & Haas Co., Philadelphia. A parasiticidal composition as the sole fungicidal and insecticidal agent the copper salt of an N-acylated amino acid selected from meta-aminobenzoic acid and apra-aminobenzoic acid and a carrier therefore.

2,413,710. **Spraying Apparatus.** Patent issued to John P. Jason, Chicago, assignor by mesne assignments, to Sprayer Corporation of America, Chicago. A hand-portable, compact, unitary liquid spraying device of the class described comprising a liquid container having a threaded top opening, a partitioning member threaded onto said threaded opening in said container to provide a cover therefore, said partitioning member having a flat bearing surface formed on its bottom side, an encased motor mounted upon said partitioning member, a rotor driven by said motor and having its upper side bearing against said flat bearing surface, and a sleeve surrounding said rotor and adjustably engaging the flat bearing surface of said partitioning member for radial adjustment with respect to said rotor.

2,415,282. **Toxic Compositions.** Patent granted February 4, 1947, to Frank W. K. Hartshorne, Quincy, Fla., assignor to Floridin Co., Warren, Pa, A toxic composition comprising an intimate mixture of fuller's earth of the Georgia-Florida type and a parasiticidal agent, the fuller's earth containing a substantial amount of its water of hydration.

2,415,464. **Process for ammoniating acid phosphates.** Patent issued February 11, 1947, to Eugene D. Crittenden, Petersburg, Va., assignor to the Solvay Process Co., New York. The process for producing an ammoniated superphosphate fertilizer, whereby reversion to the citrate-insoluble form is prevented, which comprises mixing an acid superphosphate substantially simultaneously with uncombined ammonia, which reacts exothermically therewith, and with solid ammonium bicarbonate, which reacts endothermically therewith, in proportions such that there are added at least 15 pounds of the uncombined ammonia for every 1,000 pounds of the acid phosphate present, and the ratio of solid ammonium bicarbonate to the total neutralizing ammonia reacted with the acid phosphate is such that the heat absorbed during the endothermic neutralization with ammonium bicarbonate is substantially equivalent to the heat given off during the exothermic neutralization, with the uncombined ammonia, whereby reversion of the phosphate to the citrate-insoluble form due to a rise in temperature is prevented.

Trade Mark Applications

TYKOR . . . Reverse capital letters enclosed in circle with chemical equipment background motif, for insecticides, insect and stock sprays. Filed Oct. 30, 1946, by Tykor Products, Inc., New York. Claims use since April 17, 1946.

TABU . . . in slender capital letters, for ground bone fertilizer, dried blood fertilizer, and animal manure compounds. Filed Apr. 20, 1946, by Consolidated Cosmetics, Chicago, assignor to Veralin, Inc., Chicago. Claims use since Apr. 18, 1946.

CAL-C-NATE . . . in black capital letters, for insecticides. Filed October 29, 1945, by Charles R. Parsons, doing business as Parsons Chemical Works, Grand Ledge, Mich. Claims use since Feb. 1, 1945.

TUFOR . . . in heavy black capital letters, for weed killer. Filed April 20, 1946, by United States Rubber Co., New York. Claims use since Dec. 13, 1945.

TRE-TEX . . . in capital letters, the first and last letters being larger than the others, for chemical preparation for repelling animals and insects. Filed May 8, 1946, by E. L. Eckerley, Hamilton, Ind. Claims use since Apr. 23, 1946.

DRIOX . . . in capital letters slanting upwards to the center, for nitrogen. Filed May 20, 1946, by the Linde Air Products Co., New York. Claims use since September, 1945.

CHEM-I-KILL . . . in hand drawn capital letters, for insecticide. Filed Oct. 31, 1945, by Chemical Assocciates of America, Inc., New York. Claims use since Sept. 20, 1945.

RIBBITS . . . in capital letters, for chemical preparations for stimulating the growth of plants, chemical preparations for repelling and destroying plants, weeds, and animals. Filed Feb. 28, 1946, by Commanditaire Vennootschap Chemische Fabriek Rids, Ijmuiden, Netherlands. Claims use since October 29, 1945.

MOUSE NOX . . . In heavy capital letters, in two lines, for rodenticides. Filed April 15, 1946, by J. A. Stanley, doing business as Stanley Industries, Seattle, Wash. Claims use since Jan. 2, 1940.

Trade Marks Granted

426,960. Medicinal compound for the prevention of and removal of intestinal worms from poultry, livestock, etc. Filed Jan. 17, 1946, by Dean M. Schlarbaum, doing business as A-1 Remedy Co., Albuquerque, N. Mex.

426,964. Insecticides, disinfectants, garden spray, and chemical weed killer. Boyle-Midway, Inc., Jersey City, N.J. Filed Feb. 14, 1946.

426,981. Chemical products for use in combating fungi in the Agricultural field. Monsanto Chemical Co., St. Louis. Filed March 14, 1946.

426,999. Insecticides and insect sprays of the residual and contact types. Dorsett-Jones, Inc., Baltimore, Md. Filed Apr. 11, 1946.

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The Ideal Diluent for Insecticidal Dusts

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NON-ABRASIVE
in mixing and dusting machinery

STICKS
even on waxy foliage

GIVES
uniform coverage

INERT
to the Nth degree

COMPATIBLE
with both organics and inorganics

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diluent for DDT mixtures

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in color—No need to artificially color compounds

MILLED
to specifications if desired

Analysis, Quotations and Samples on Request

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DUST DRIFT CONTROL

(*Continued from Page 54*)

flected in a reduction in the size of tomatoes. There are also reports of DDT causing injury to tomatoes, and because of this there is some possibility that the lower yield which occurred in the 5 per cent DDT treatment might be traceable to DDT.

Apparently there is little danger of a serious DDT residue problem on tomato. DDT analyses were run on tomatoes from the 3 and 5 per cent treatments. Tomatoes picked on September 5, thirteen days after the second dusting, showed a trace of DDT for the 3 per cent treatment and 0.59 ppm for the 5 per cent treatment.

Summary and Conclusions

INVESTIGATIONS conducted in 1946 demonstrated that a seven foot adjustable rigid hood supplied with end and side drapes was not effective in confining the drift of calcium arsenate. The addition of 2 to 4 per cent of a highly refined oil was also ineffective in preventing drift.

The drift hazard was eliminated where calcium arsenate was applied as a concentrated oil-water suspension spray, either by ground rig or by airplane. The composition of the spray was as follows:

Oil emulsion	1 gallon
Water	3 gallons
Commercial arsenate	12 pounds

Excellent control resulted where the above mixture was applied at the rate of 8 gallons per acre with a three-row compressed-air atomizing-power sprayer. This method shows much promise and is ready for testing on a rather large experimental commercial scale.

Where the mixture was applied by airplane, the results were encouraging but not as promising as where the material was applied by ground machine. There is need of developing precision shutoff valves at the nozzles, adequate agitation in the tank, and improvements in the atomizing device that will insure an accurate rate of delivery and the desired particle size. These developments must be accomplished before this method of pest control can be tested on a rather extensive experimental commercial scale.

There is some possibility that the tomato mite may increase in fields that are treated with the calcium arsenate-oil-water suspension spray. However, it is believed that any danger of a serious outbreak can be avoided if the fields receive a thorough application of sulfur between July 10 and 15.

DDT and DDD both resulted in excellent control. These materials are ready for testing on a rather wide experimental commercial scale. Unlimited recommendations cannot be made at this time. These materials have not stood the test of time and must be used with considerable caution until it is certain that they do not have some serious limitations. Under certain conditions, DDT is known to be injurious to tomato. It is believed that injury is associated with high temperatures and where severe, reduces the sizes of tomatoes which results in a supression of the yield.

Although much progress has been made, none of the new methods of control have advanced to a point where they can be substituted for the old standard methods. In places growers might use cryolite instead of calcium arsenate in their pest control program. In no case should insecticides be applied unless there is a definite need for them. Application of dusts should be made only when weather conditions are ideal. Further, some of the trouble caused by the drift of calcium arsenate can be avoided if the farmers will cooperate with one another. Dusting of tomato fields adjacent to alfalfa or pasture land should be postponed until the alfalfa crop is harvested or until the pasture is thoroughly grazed.

The investigation will be continued. The work of the past season will be expanded and new methods of application as well as new materials will be tested. There is every reason to expect that an effective control program will be developed to eliminate the hazard which now results from the use of calcium arsenate dust.★★

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 1st of month.

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Entomologist — Young man, five years practical experience, desires position with insecticide firm in research or sales development. Cornell graduate. Prefer northeastern states location. References and further details, communicate with Box 148, care of *Agricultural Chemicals.*

Entomologist: Practical, college training; seeks connection with manufacturer of insecticides, etc., in rearing and testing products. Mature experience in methods and laboratory technique. Regularly employed. Address Box 149 care of *Agricultural Chemicals.*

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Use TYKOR INSECTICIDAL WHITE in place of whitewash. Contains DDT—providing long time killing action against flies, gnats, mites, mosquitos, spiders, etc. Simply mix with water and apply. Ideal for barns, poultry and hog houses, etc.

See large ad on page 48 and write for full information and prices.

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Insecticides — Formulation
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Keeping in the picture..

IF you wish to make a good impression on the agricultural insecticide, fungicide, weed killer or fertilizer market, you can keep "in the picture" by consistent appearance in the advertising columns of this magazine.

No need of scattering your shots over a wide territory where only a fraction of the audience may be interested in your story. Shoot for the logical market through the logical medium reaching those you wish to impress. Keep in the picture through the advertising columns of

AGRICULTURAL CHEMICALS

254 WEST 31st STREET NEW YORK 1

TALE ENDS

THE Purdue University Agricultural Experiment Station's annual report tells of a pulverizer-picker for corn which not only does a job of picking, but in addition is said to kill from 94 to 96 percent of the corn borer larvae in the stalks which pass through the pulverizer. The machine, which cuts the stalks about one inch above the ground, leaves only about 3 percent of larvae remaining in the stubble. The remainder depends upon such factors as the time the corn was planted, date of picking, and the kind of hybrid it is. However, those remaining three percent are prolific creatures, and can produce an astounding number of offspring. Only chemical insecticides can be counted on for a thorough job of handling corn borer. (AGRICULTURAL CHEMICALS will soon feature an article on control of the corn borer.)

•

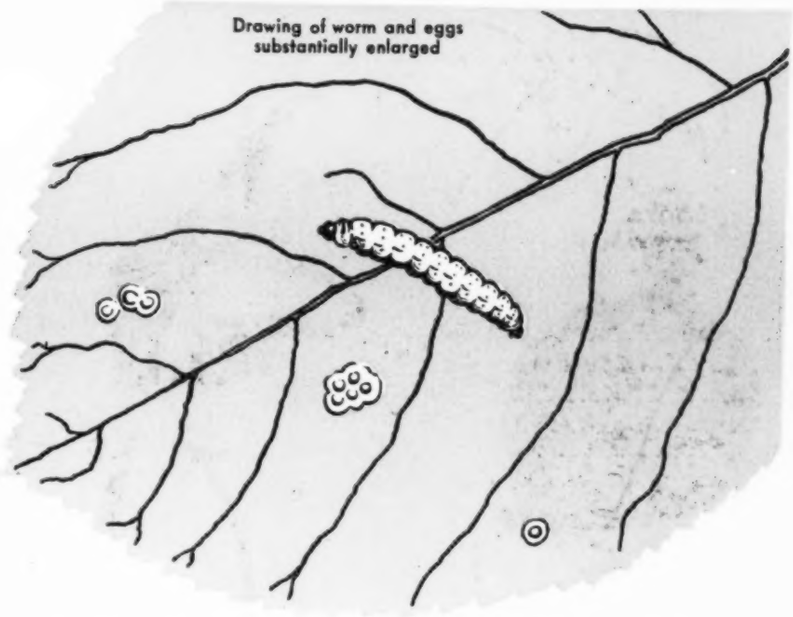
List of suppliers of weed killers and allied chemicals used in cemetery maintenance is wanted by the National Cemetery Association. If you have an interest in selling the cemetery people, send the dope about your products to Martin F. Guadian, National Cemetery Ass'n., 1427 Eye St., N.W. Washington, D.C.

•

In an illustrated lecture at the recent Potomac Division meeting of the American Phytopathological Society at Beltsville, Md., Dr. R. E. Larson of the University of Wisconsin showed a photo of a museum in London which had been badly damaged by a nearby bomb blast. All the windows in the building were blown out, and the glass cases containing thousands of exhibits were likewise broken. Thus unprotected from the weather, seed exhibits which had been kept in containers for as long as 150 years sprouted when rain was allowed to enter the building through the openings.

CODLING MOTH

{Carpocapsa pomonella}



Drawing of worm and eggs substantially enlarged

BUG OF THE MONTH

THIS month we give you the codling moth —scourge of the apple tree. Unchecked, it infests 20 to 95% of the entire crop. Even with the best of pre-war control measures, injury usually ran from 5 to 10%. In fact, this pest has become so deeply indigenous that it has put whole sections of the country out-of-bounds for apple growing.

Here is a real challenge to your manufacturing and marketing skill. For, with some of the newer insecticide materials at your command, used in accordance with the latest extension service recommendations, this trend can be reversed.

According to the best present information, DDT in water suspension, with DN 111 or other suitable Red Mite control added to prevent unbalanced buildup, is the most effective spray. Such a spray gives excellent mortality and has excellent residual action.

We suggest that you plan to use Prentox Micro Mesh Wettable DDT Powder (50% DDT) in your sales program for 1947. The use of this specially-formulated material will assure uniform coverage, optimum suspension, and tenacious residues on foliage and fruit.

Regardless of your present source of toxicants, our ideas on effective and economical formulations for sale to farmers, orchardists, nurserymen and home gardeners may be had without obligation. The specialized knowledge of our entire technical staff is always at your disposal, for consistently better insecticides.

R. J. PRENTISS & CO., Inc.

110 WILLIAM STREET, NEW YORK 7, N. Y.

9 SO. CLINTON STREET, CHICAGO 6, ILL.

TURN TO PAGE 3 — THIS ISSUE — FOR PRENTISS POLICY

A NEW ERA IN INSECT CONTROL

VELSICOL 1068*

in AGRICULTURAL FORMULATIONS

NON-PHYTOTOXIC

In the extensive experimental work which has been conducted to date in agriculture with effective formulations of VELSICOL 1068 there has been no record of plant injury due to the compound $C_{10}H_6Cl_8$. This indicates that VELSICOL 1068 is safe to use on vegetative crops.

VELSICOL 1068 CONCENTRATE SPRAY OIL SOLUTIONS

For airplane dispersals or concentrate sprayers.
VELSICOL 1068 TECHNICAL is completely soluble in all proportions in all aliphatic and aromatic solvents.

*Patents Pending

VELSICOL 1068 EMULSION CONCENTRATES

1. Use of VELSICOL 1068 with oil and emulsifier.
   Formulation recommended for quick breaking emulsion:
   62½% by vol. VELSICOL 1068 TECHNICAL.
   32½% by vol. Deodorized Kerosene.
   5% by vol. of an oil soluble non-alkaline emulsifier.
   Each pint of this concentrate contains 1 lb. of VELSICOL 1068 TECHNICAL.
2. Use of VELSICOL 1068 with water and emulsifier.

VELSICOL 1068 INSECTICIDAL DUSTS

Up to 5% by weight on non-absorptive powders such as talc or pyrophyllite.
Up to 50% by weight on absorptive powders such as diatomaceous earth or fossil flour.
Makes excellent uniform dusts with good physical properties.

VELSICOL 1068 WETTABLE POWDERS

These are readily made by the use of 3% of a good wetting agent with a 50-50 mix by weight of VELSICOL 1068 TECHNICAL and an absorptive carrier.

For agricultural work VELSICOL 1068 is available in Technical Grade, 90% purity.
Consult VELSICOL'S staff regarding further details. Samples on request.

VELSICOL Corporation

Manufacturers of: Insect Toxicants • Synthetic Resins • Coresin Core Oils • Aromatic Solvents

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In Canada: Natural Products Corp., Montreal 2